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Clifford B. Upton • Kenneth G. Fuller



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AMERICAN ARITHMETIC, GRADE 6

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Illustrations by Sylvia Haggander
and William Riley

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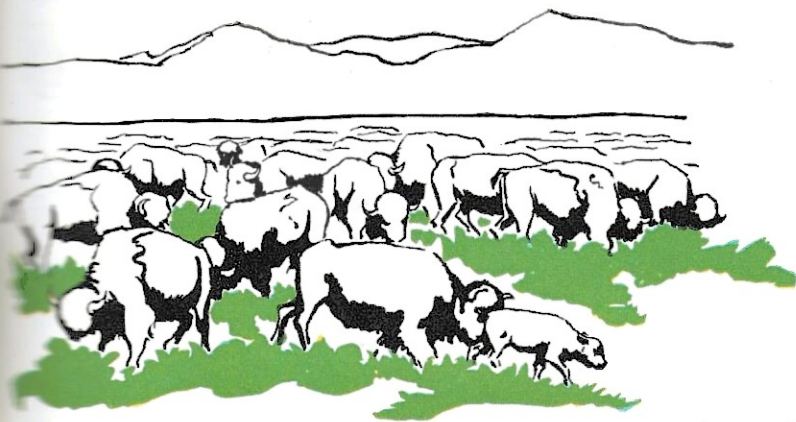




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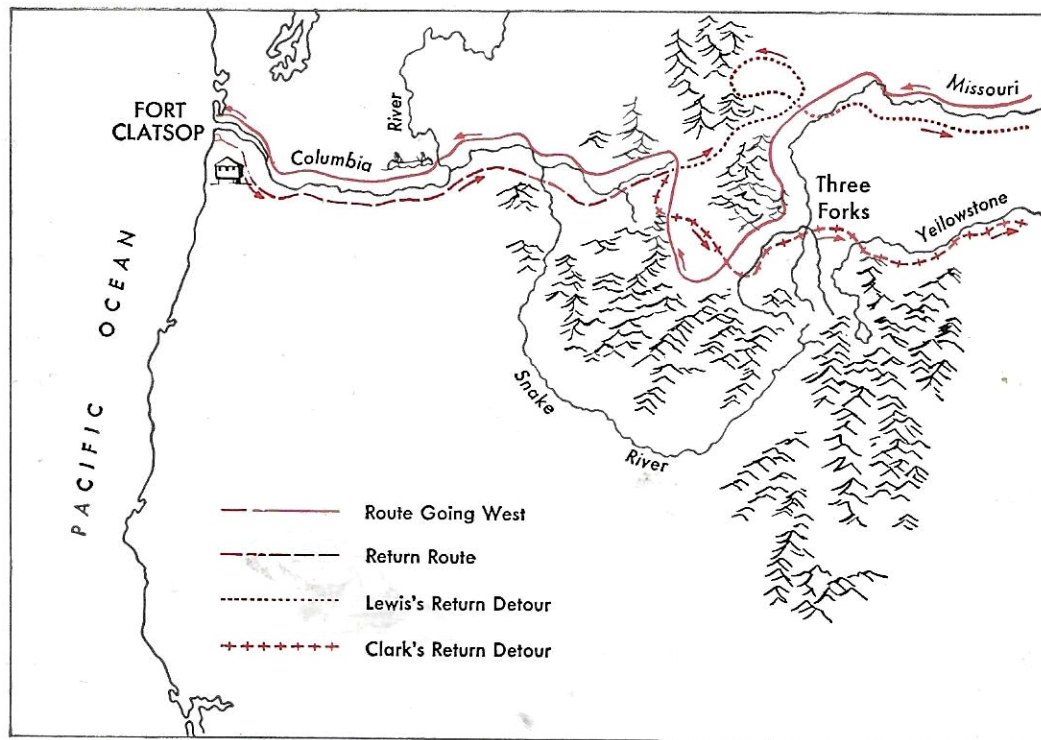
Chapter 1



Lewis and Clark Expedition

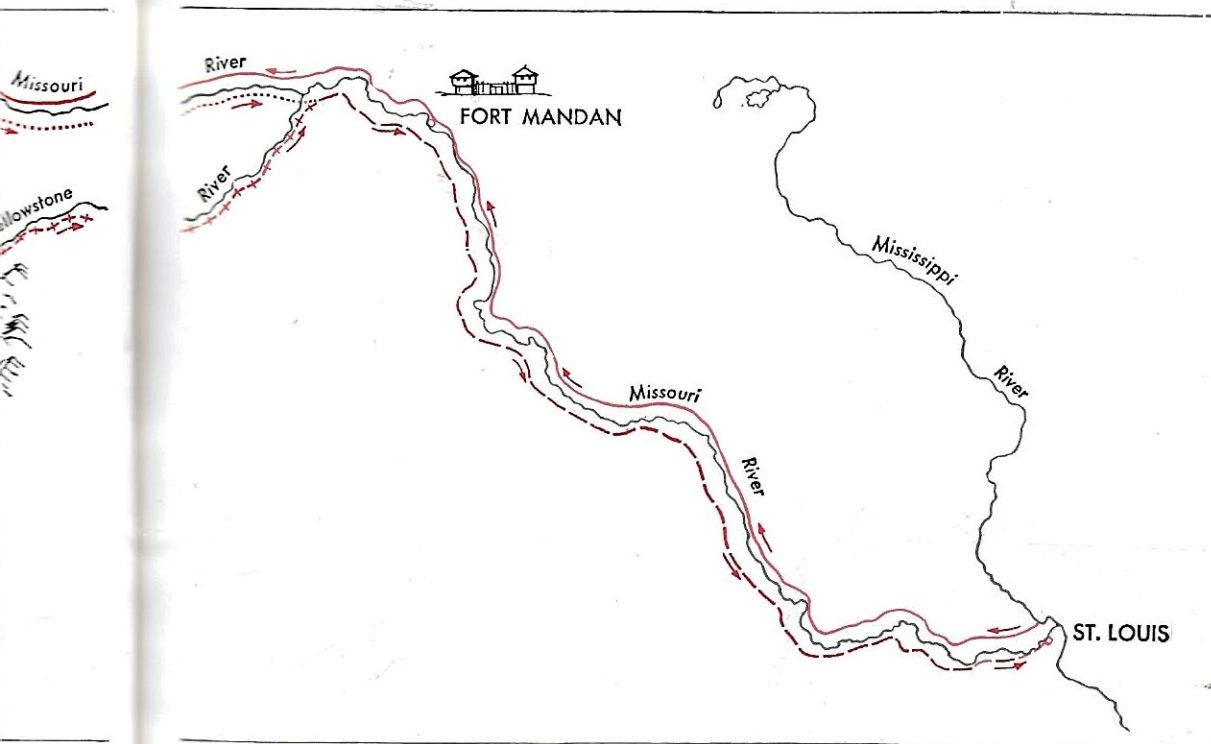
When Thomas Jefferson was President of the United States, he sent out an expedition commanded by Lewis and Clark with orders to go up the Missouri River to its beginning and continue west to the Pacific Ocean. The purpose of this exploration was to arrange for fur trading with the Indians and to study the possibilities of this region for new settlers.

1. The Government allowed \$2500 to cover the cost of supplies for the expedition. Of this amount $\frac{1}{4}$ was to be spent for red coats, bright-colored handkerchiefs, tomahawks, knives, looking glasses, flags, and beads as gifts for the Indians. How much money was to be spent on Indian gifts?
2. Lewis and Clark left St. Louis May 14, 1804, and started up the Missouri River. On October 31 they reached a place near what is now Bismarck, North Dakota. They built a camp there, called Fort Mandan, where they spent the winter. How many days did the trip to Fort Mandan take? To find the number of days, think: "After May 14, there are 17 days left in May. There are 30 days in June, 31 in July, 31 in August, 30 in September, and 31 in October." Add these numbers to find the number of days.
3. The distance from St. Louis to Fort Mandan was 1600 mi. Did the party travel about 9 mi. a day or about 10 mi. a day? Multiply 170 by 9; then multiply 170 by 10 and see which is closer to 1600. See the map on pages 2 and 3.



Lewis and Clark Expedition

1. After spending the winter at Fort Mandan, Lewis and Clark left the Fort on April 7, 1805, and continued their trip up the Missouri River to a place called Three Forks where the Missouri proper begins. They arrived there on July 25. How many days did the trip take? See the map above.
2. The men then crossed the Rocky Mountains and continued west until they came to the Columbia River. On October 16 they started down the Columbia in canoes and reached the Pacific Ocean on November 7, 1805, where they built a camp called Fort Clatsop in which they spent the winter. How many days did the Columbia River trip take?
3. The trip from Fort Mandan to Fort Clatsop took a total of 214 da. and covered 2534 mi. Was the speed of travel on this trip about 11 mi. a day or about 12 mi. a day? In ex. 3, page 1, you are told that the men traveled 1600 mi.



in going from St. Louis to Fort Mandan. How many miles in all did they travel on the complete trip across the country from St. Louis to Fort Clatsop?

4. Lewis and Clark left Fort Clatsop on March 23, 1806, to begin the long journey back to St. Louis. When they reached the Rocky Mountains the expedition divided into two groups. Later, at the mouth of the Yellowstone River, Clark's party rejoined Lewis and his party for the rest of the trip home. They arrived back in St. Louis on September 23, 1806. How many days did the return trip take? See the map above.
5. When they arrived in St. Louis there were 33 men of the party who had been on the complete round trip. As an extra reward to these men, the Government told them that each man could put in a claim for 320 acres of land in this new region. Find the total number of acres of land the Government was ready to give these men.

The Meaning of Numbers

1. Lewis and Clark traveled 2534 mi. in 214 da. The number 214 is a 3-place, or 3-figure, number, while 2534 is a 4-place number. Tell what each figure in each number means.
2. Bill's father drove his car 23,835 mi. last year. Tell what each figure in this 5-place number means.
3. Ann's father traveled 123,500 mi. by airplane last year. Tell the meaning of each figure in this 6-place number.
4. Numbers containing 4, 5, or 6 figures stand for **thousands**. The figures are separated by commas into groups of 3 figures each, beginning at the right. These groups are called **periods**. Sometimes the comma is left out in a 4-place number.
5. There are 56,000,000 passenger cars in use on our streets and highways. This number is read 56 **million**.
6. In a recent year the airlines in our country carried 48,564,000 passengers. This number is read 48 **million**, 564 **thousand**.
7. Recently there were 3,620,962 people living in Chicago. This number is read 3 **million**, 620 **thousand**, 962.
8. During one year our post offices handled 59,077,633,000 pieces of mail. This large number has 11 places and is read 59 **billion**, 77 **million**, 633 **thousand**.
9. Numbers containing 7, 8, or 9 figures stand for **millions**. Numbers containing 10, 11, or 12 figures stand for **billions**. Millions is the third period counting from the right. Billions is the fourth period. Here are the names of the periods:

Billions	Millions	Thousands	Ones
281,	372,	640,	357,

The number above is 281 **billion**, 372 **million**, 640 **thousand**, 357. It has 12 places. Tell what each figure means.

10. In each number put commas in the proper places to separate the number into periods; then read the numbers: 63593221; 4882935; 293645707; 8539645279; 321456035232; 7543007.

Large Numbers

1. There are about 52,252,000 telephones in the United States. Read this number.
2. The number of people living in some of our cities in a recent year is given below. Read these numbers:

City	Number of People	City	Number of People
Boston	801,444	Philadelphia	2,071,605
Chicago	3,620,962	Buffalo	580,132
Columbus	375,901	St. Paul	311,349
New York	7,891,957	St. Louis	856,796

Read the numbers above in order, beginning with the largest.

3. The number of eggs produced one year in certain states is given below. Read these numbers:

State	Number of Eggs	State	Number of Eggs
California	3,812,000,000	Ohio	2,436,000,000
Minnesota	3,914,000,000	Iowa	4,651,000,000
Missouri	2,443,000,000	Illinois	2,934,000,000
Pennsylvania	3,345,000,000	Indiana	2,332,000,000

Which of these states produced the largest number of eggs?

Write these numbers in figures:

4. Four million, three hundred twenty thousand, six hundred.
5. Fifteen billion, eleven million, nine thousand, sixty.
6. Six hundred thirty-five million, four hundred thousand.
7. Seven billion, fifteen thousand, nine hundred thirty.
8. Fifty million, eight hundred nine thousand, twenty-four.
9. One hundred eighty billion, two hundred ninety million, nineteen thousand, forty-six.
10. Twelve million, five hundred thirteen thousand, eight hundred seventeen.
11. Bring to class newspaper clippings containing numbers with 10 or more figures. Read these numbers.

The 100 Addition Facts

This is a test on the addition facts. You should be able to give all the sums orally within the time stated by the teacher. Make a list of any facts that give you trouble and practice on them:

1. $\begin{array}{r} 3 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 9 \\ \hline \end{array}$
2. $\begin{array}{r} 4 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 0 \\ \hline \end{array}$
3. $\begin{array}{r} 5 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 7 \\ \hline \end{array}$
4. $\begin{array}{r} 5 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 7 \\ \hline \end{array}$
5. $\begin{array}{r} 2 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 3 \\ \hline \end{array}$
6. $\begin{array}{r} 7 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 9 \\ \hline \end{array}$
7. $\begin{array}{r} 4 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 2 \\ \hline \end{array}$
8. $\begin{array}{r} 8 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 2 \\ \hline \end{array}$
9. $\begin{array}{r} 0 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 3 \\ \hline \end{array}$
10. $\begin{array}{r} 9 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 5 \\ \hline \end{array}$

To the Teacher. See the suggestions on page 327 for giving this diagnostic test on the fundamental addition facts.

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Exercises 2
See how qu

2. Count
3. Count
4. Count
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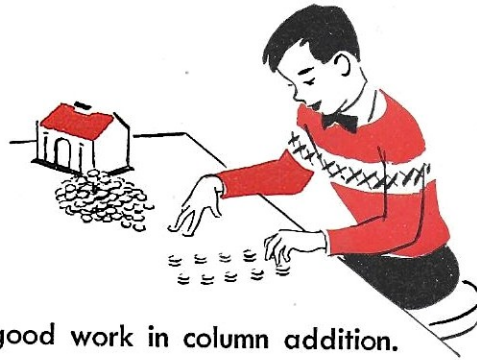
6. 63
7. 91
8. 46
9. 29
10. Add 6

Do the work

11. $17 + 4$
12. $24 + 7$
13. $38 + 8$
14. $64 + 8$
15. $78 + 6$
16. $36 + 7$

Getting Ready for Column Addition

- Henry emptied his bank for pennies and counted them. He counted the pennies two at a time and found that he had saved 90 pennies. Count by 2's to 90. Count by 3's to 90. Count by 5's to 90.



Exercises 2 to 16 will help you to do good work in column addition. See how quickly you can give the answers:

- Count by 2's from 7 to 49; by 5's from 3 to 58.
- Count by 3's from 8 to 65; by 4's from 9 to 81.
- Count by 6's from 2 to 44; by 7's from 6 to 90.
- Count by 8's from 1 to 65; by 9's from 3 to 57.

Add 5 to each number. Do the work mentally:

6. 63	49	17	84	32	56	93	28
7. 91	26	34	68	77	43	57	88
8. 46	74	53	15	92	75	37	52
9. 29	94	89	38	71	69	45	86

10. Add 6 to each number in ex. 6 to 9. Add 8; add 9.

Do the work mentally:

11. $17 + 4$	$32 + 9$	$87 + 5$	$65 + 6$	$46 + 8$
12. $24 + 7$	$59 + 3$	$76 + 6$	$44 + 9$	$39 + 5$
13. $38 + 8$	$85 + 8$	$19 + 4$	$73 + 7$	$26 + 9$
14. $64 + 8$	$57 + 9$	$46 + 5$	$29 + 8$	$58 + 7$
15. $78 + 6$	$89 + 9$	$63 + 8$	$17 + 7$	$65 + 9$
16. $36 + 7$	$19 + 6$	$28 + 9$	$85 + 5$	$49 + 7$

Column Addition

1. **Problem** Find the sum of 3, 8, 4, and 9.

Explanation Write the numbers in a column and add up. Think "9, 13, 21, 24." Write the answer 24. In addition the numbers you add are called the **addends**. The answer is called the **sum**. To check, begin at the top of the column and add down.

$$\begin{array}{r} 3 \\ 8 \\ 4 \\ 9 \\ \hline 24 \end{array} \left. \begin{array}{l} \text{Addends} \\ \text{Sum} \end{array} \right\}$$

2. Find the sum of these numbers: 4, 3, 9, 6, 2.
3. On five days John worked 2 hr., 3 hr., 4 hr., 2 hr., and 4 hr. How many hours in all did John work?

Add up. Check by adding down. Write answers on folded paper:

4.	<u>8</u> 4 7 6 3 4	<u>4</u> 7 5 5 7 2	<u>5</u> 6 4 8 4 5	<u>9</u> 4 7 3 9 9	<u>8</u> 6 9 5 1 7	<u>4</u> 6 7 5 5 8 3	<u>5</u> 7 5 9 6 8	<u>8</u> 6 8 7 9 6	<u>6</u> 8 9 4 7 7
5.	<u>84</u> 78 92 43	<u>22</u> 53 36 59	<u>79</u> 32 63 46	<u>23</u> 75 69 27	<u>53</u> 81 32 26	<u>69</u> 91 75 18			
6.	<u>48</u> 67 16 83 58	<u>47</u> 56 65 78 69	<u>76</u> 96 74 59 85	<u>94</u> 59 18 97 34	<u>59</u> 60 38 41 49	<u>45</u> 38 68 50 37			
7.	<u>37</u> 29 42 48 63 29	<u>53</u> 61 79 89 32 16	<u>76</u> 80 39 70 42 24	<u>61</u> 87 40 61 28 53	<u>99</u> 88 27 69 81 74	<u>54</u> 77 69 56 47 89			

To the Teacher. For use of folded paper, see page 56.

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Add up.

4. $\begin{array}{r} 654 \\ 349 \\ 586 \\ 908 \\ \hline 645 \end{array}$

5. $\begin{array}{r} 452 \\ 176 \\ 578 \\ 611 \\ \hline 574 \end{array}$

6. $\begin{array}{r} 2419 \\ 462 \\ 928 \\ \hline 163 \end{array}$

More Practi

Adding Larger Numbers

- To add the numbers in the example at the right, start at the bottom of the ones column and add up. Think, "4, 13, 16, 24, 27." Write 7 in ones place and carry 2 to the tens column. Then think, "5, 11, 15, 24, 31." Write 1 in tens place and carry 3 to the hundreds column. Add hundreds column the same way.

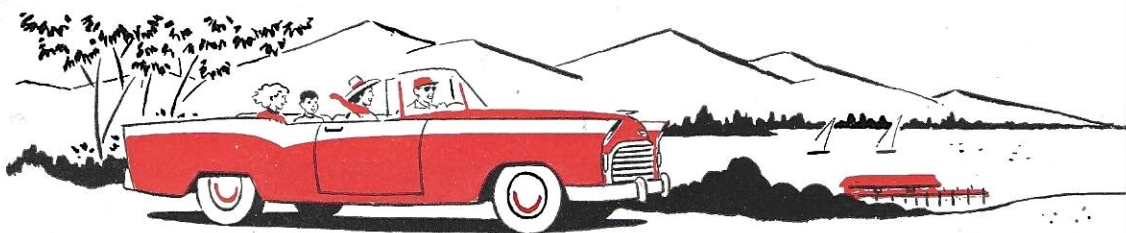
473
 298
 643
 469
 534
2417

- In ex. 1, when you carry the 2 of 27 to the second column, what does the 2 stand for? When you carry the 3 of 31 to the third column, what does this 3 stand for?
- The best way to check column addition is to add down each column. In the example above, as you add down the first column think, "11, 14, 23, 27." The sum is 27 again, so the first column is checked. Carry the 2 of 27 to the top of the second column and check that column by adding down. Then check the third column.

Add up. Check by adding down:

4.	654 349 586 908 <u>645</u>	376 627 774 635 <u>402</u>	493 772 587 764 <u>384</u>	459 238 652 899 <u>113</u>	116 854 357 896 <u>637</u>	708 723 228 995 <u>346</u>
5.	452 176 578 611 <u>574</u>	369 445 171 847 <u>289</u>	378 493 502 469 <u>613</u>	642 515 479 698 <u>729</u>	830 649 858 592 <u>304</u>	329 273 289 258 <u>758</u>
6.	2419 462 928 163	1719 634 2369 417	799 407 512 3124	2602 1319 746 3247	1470 3891 1785 2609	

More Practice. See 1 on page 310.



Problems and Practice

Do on paper

1. Last summer Ann's father took his family on a trip. It cost \$37.85 for gasoline and oil, \$94.80 for meals and rooms, and \$24.75 for other things. Find the total cost of this trip.
2. When Jack's family went on a trip, Jack kept a record of the number of miles traveled each day. For the first day his record showed a distance of 287 mi.; for the second day, 316 mi.; for the third day, 269 mi.; and for the fourth day, 307 mi. Find the total distance traveled during the first four days of the trip.
3. Before school opened in the fall, Helen and her mother went shopping. They bought for Helen a dress for \$12.95, a sweater for \$3.49, a pair of shoes for \$7.50, and a raincoat for \$9.98. Find the total cost of their purchases.
4. At the Smith School there are 27 children in the first grade, 31 in the second grade, 36 in the third grade, 29 in the fourth grade, 32 in the fifth grade, and 28 in the sixth grade. How many children in all go to the Smith School?
5. Mr. White sold 179 doz. eggs in January, 215 doz. in February, 273 doz. in March, 295 doz. in April, 216 doz. in May, and 196 doz. in June. How many dozen eggs did Mr. White sell in this six-month period?

Copy, add, and check:

6. $\$15.16 + \$8.49 + \$2.05 + \$3.97 + \$10.50 + \$3.15$
7. $\$7.87 + \$24.65 + \$13.24 + \$8.53 + \$1.98 + \$12.46$
8. $\$3.63 + \$35.79 + \$4.44 + \$11.45 + \$18.75 + \$3.20$
9. $\$36.93 + \$8.29 + \$5.56 + \$12.72 + \$46.60 + \$7.38$

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The 100 Subtraction Facts

This is a test on the subtraction facts. You should be able to give all the answers orally within the time stated by the teacher. Make a list of any facts that give you trouble and practice on them:

1. $\begin{array}{r} 4 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 15 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 14 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 12 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 4 \\ \hline \end{array}$
2. $\begin{array}{r} 3 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 15 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ 0 \\ \hline \end{array}$
3. $\begin{array}{r} 9 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 12 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 16 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 13 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 15 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 13 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 4 \\ \hline \end{array}$
4. $\begin{array}{r} 12 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 13 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 12 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 17 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 1 \\ \hline \end{array}$
5. $\begin{array}{r} 15 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 14 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 12 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 2 \\ \hline \end{array}$
6. $\begin{array}{r} 7 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 17 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 3 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 7 \\ \hline \end{array}$
7. $\begin{array}{r} 13 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 18 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 13 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 12 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 14 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 2 \\ \hline \end{array}$
8. $\begin{array}{r} 16 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 12 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 13 \\ 4 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 3 \\ \hline \end{array}$
9. $\begin{array}{r} 9 \\ 6 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 1 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 1 \\ 0 \\ \hline \end{array}$
10. $\begin{array}{r} 16 \\ 9 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 10 \\ 8 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 14 \\ 7 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 5 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ 0 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ 2 \\ \hline \end{array}$ $\begin{array}{r} 14 \\ 6 \\ \hline \end{array}$

To the Teacher. See the suggestions on page 327 for giving this diagnostic test on the fundamental subtraction facts.

Subtraction

1. If you forget the answer to a subtraction fact, you can get it easily in this way. If you forget what 9 from 13 equals, think, "9 and what make 13?" If you remember that 9 and 4 are 13, then you know that 9 from 13 is 4.
2. If you forget what 6 from 11 equals, think, "6 and what are 11?" Since 6 and 5 are 11, this shows that 6 from 11 is 5. How should you think if you forget the answer to 7 from 12? to 4 from 11? to 8 from 17? to 9 from 16?
3. **Problem** Subtract 185 from 314.

Explanation Write 185 under 314.

Think, "14 - 5 = 9." Write 9. Think, "10 - 8 = 2." Write 2. Think, "2 - 1 = 1." Write 1. The answer is 129.

314 Minuend
185 Subtrahend
129 Remainder

4. In a subtraction example, the number from which you subtract is called the **minuend**, the number which you subtract is called the **subtrahend**, and the answer is called the **remainder**, or the **difference**.
5. To check a subtraction example, add the remainder to the subtrahend, **adding up**. You should get the minuend.
6. Explain how the remainder is found in each example below:

79	90	127	942	500	286	428
47	18	59	686	237	192	424
<u>32</u>	<u>72</u>	<u>68</u>	<u>256</u>	<u>263</u>	<u>94</u>	<u>4</u>

Subtract and check. Write the answers on folded paper:

7. 81	113	417	871	723	700	4000
<u>37</u>	<u>87</u>	<u>283</u>	<u>236</u>	<u>189</u>	<u>234</u>	<u>1275</u>
8. 63	146	626	600	814	562	2206
<u>29</u>	<u>29</u>	<u>491</u>	<u>417</u>	<u>297</u>	<u>129</u>	<u>997</u>

More Practice. See 2 on page 310.

To the Teacher. See page 329 for the additive method of subtraction.

Problems and Practice



1. The sixth grade sold 123 tickets to the spring folk dances and the fifth grade sold 89 tickets. How many more tickets did the sixth grade sell than the fifth grade?
2. Mary received \$10.00 from her grandfather on her birthday. If she buys a blouse for \$3.69, how much money will she have left?
3. Henry and his family are making an automobile trip to a city 500 mi. away. On the first day they traveled 284 mi. How many more miles do they have to travel?
4. Last year 9241 school children borrowed books from the public library. Of these borrowers 4728 were grade school pupils. How many borrowers were high school pupils?

Subtract and check. Write answers on folded paper:

5. $\begin{array}{r} 4833 \\ 1246 \\ \hline \end{array}$	$\begin{array}{r} 2919 \\ 2437 \\ \hline \end{array}$	$\begin{array}{r} 6534 \\ 2635 \\ \hline \end{array}$	$\begin{array}{r} 73146 \\ 57457 \\ \hline \end{array}$	$\begin{array}{r} 70000 \\ 42398 \\ \hline \end{array}$
6. $\begin{array}{r} 1655 \\ 687 \\ \hline \end{array}$	$\begin{array}{r} 5000 \\ 2465 \\ \hline \end{array}$	$\begin{array}{r} 4288 \\ 1535 \\ \hline \end{array}$	$\begin{array}{r} 16276 \\ 8628 \\ \hline \end{array}$	$\begin{array}{r} 35643 \\ 17987 \\ \hline \end{array}$
7. $\begin{array}{r} 5018 \\ 4568 \\ \hline \end{array}$	$\begin{array}{r} 7188 \\ 3759 \\ \hline \end{array}$	$\begin{array}{r} 4000 \\ 2152 \\ \hline \end{array}$	$\begin{array}{r} 91421 \\ 72394 \\ \hline \end{array}$	$\begin{array}{r} 14932 \\ 6165 \\ \hline \end{array}$
8. $\begin{array}{r} 8587 \\ 2338 \\ \hline \end{array}$	$\begin{array}{r} 8783 \\ 6994 \\ \hline \end{array}$	$\begin{array}{r} 4630 \\ 3586 \\ \hline \end{array}$	$\begin{array}{r} 60000 \\ 47647 \\ \hline \end{array}$	$\begin{array}{r} 73946 \\ 72969 \\ \hline \end{array}$
9. $\begin{array}{r} 8000 \\ 4323 \\ \hline \end{array}$	$\begin{array}{r} 7241 \\ 6895 \\ \hline \end{array}$	$\begin{array}{r} 1652 \\ 799 \\ \hline \end{array}$	$\begin{array}{r} 73417 \\ 19431 \\ \hline \end{array}$	$\begin{array}{r} 60900 \\ 11689 \\ \hline \end{array}$

10. Take \$74.96 from \$169.85.
11. How much less than 36,145 is 30,759?
12. How much more is 50,000 than 23,516?

Related Facts

If you have difficulty with the addition and subtraction facts, you can use related facts to help yourself, as shown below.

1. The sum of 5 and 7 is the same as the sum of 7 and 5. If you know that the sum of 7 and 5 is 12, then the sum of 5 and 7 is 12. What related fact can help you if you forget 4 and 8? 8 and 6? 3 and 5? 7 and 4?
2. The sum of 9 and 6 is the same as the sum of 10 and 5. If you forget the sum of 9 and 6, take 1 from 6 and add it to 9, making 10. Now you have 10 and 5, or 15. What can you do if you forget 9 and 4? 7 and 9? 9 and 5?
3. The sum of 6 and 7 is 1 more than the sum of 6 and 6. If you know that 6 and 6 are 12, then 6 and 7 are 1 more than 12, or 13. What can you do if you forget 7 and 8? 5 and 6? 8 and 9? You see that the doubles help you to add numbers that are near doubles.
4. It is easy to add 0 to any number. 7 and 0 are 7. How many are 6 and 0? 4 and 0? 0 and 8? Can you make a rule for adding 0 to any number?
5. Each subtraction fact is related to an addition fact. If you forget 9 from 13, what addition fact will help you? See ex. 1 on page 12. How should you think if you forget 7 from 14? 6 from 13? 4 from 11? 8 from 17?
6. It is easy to subtract 0 from any number. $5 - 0 = 5$. What is 0 from 8? 0 from 3? 0 from 9? Can you make a rule for subtracting 0 from another number?
7. It is also easy to subtract a number from itself. 8 from 8 is 0. What is 4 from 4? 5 from 5? 2 from 2? Try to make a rule for subtracting a number from itself.

Suppose you forget the answers to these facts. Show how to use a related fact to help yourself:

- | | | | | |
|------------|----------|---------|---------|----------|
| 8. $5 + 6$ | $12 - 9$ | $9 + 5$ | $5 + 3$ | $16 - 9$ |
| 9. $9 + 4$ | $13 - 7$ | $7 + 8$ | $9 + 7$ | $12 - 8$ |

Multiplication

1. The 100 multiplication facts are like the 100 addition facts on page 6 except that you multiply the numbers instead of adding them. Turn to page 6 and try to **multiply** all the numbers orally within the time stated by the teacher.

Do these mentally. Give the answers only:

$$2. \quad 6 \times 5 + 4 \qquad 4 \times 7 + 2 \qquad 9 \times 8 + 7 \qquad 5 \times 7 + 3$$

$$3. \quad 9 \times 3 + 7 \qquad 5 \times 9 + 2 \qquad 6 \times 7 + 4 \qquad 9 \times 9 + 6$$

4. Multiply each number by 8 and add 6 to the product:

$$3 \quad 9 \quad 2 \quad 7 \quad 0 \quad 6 \quad 1 \quad 5 \quad 4$$

5. **Problem** There are 52 seats in each coach of the new streamlined train. How many seats are there in all if there are 14 coaches in the train?

Explanation You multiply 52 by 14.

To do this, first multiply 52 by the 4 of 14, which gives 208. Write 208 so that the 8 comes under the 4 by which you multiplied. Then multiply

52 by the 1 of 14, which gives 52. Write 52 so that the 2 comes under the 1 by which you multiplied. Since the 1 of 14 really means 10, you have multiplied 52 by 10, which gives 520. You drop the 0 in ones place and write 52 as shown above with the 2 in tens place. Add the two products as they stand, which gives 728. There are 728 seats in all.

52	Multiplicand	
14	Multiplier	
208	}	Partial Products
52		
728		Product

6. In multiplication the number that you multiply is the **multiplicand**, the number by which you multiply is the **multiplier**, and the answer is the **product**. The numbers you add to get the product are called the **partial products**.

Multiply. Check by going over your work:

7. 32	46	72	38	68	59	82
14	19	32	27	49	24	67

More Practice. See **3** on page 310.



Using Multiplication

1. Henry and his father are putting 18 tomato plants in one row in the garden. If they plant 4 rows of tomatoes, how many tomato plants will they have all together?
2. Mr. Johnson shipped 32 cases of eggs to the city last week. There are 30 doz. eggs in a case of eggs. How many dozen eggs did Mr. Johnson ship? How many eggs is that?
3. The pupils in the sixth grade are planning a trip to the history museum. Each pupil will pay \$1.25 for the trip. How much in all will 27 pupils pay for the trip?
4. Mary sold 123 packages of flower seeds at 8¢ a package. How much money did she get for them?
 ▶ Remember that 123×8 is the same as 8×123 . The answer will be in cents and should be changed to dollars and cents.

Multiply. Check by going over your work:

5. $\begin{array}{r} 214 \\ 13 \\ \hline \end{array}$	$\begin{array}{r} 273 \\ 24 \\ \hline \end{array}$	$\begin{array}{r} 571 \\ 43 \\ \hline \end{array}$	$\begin{array}{r} 7234 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 1836 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} \$29.41 \\ 9 \\ \hline \end{array}$
6. $\begin{array}{r} 827 \\ 568 \\ \hline \end{array}$	$\begin{array}{r} 736 \\ 179 \\ \hline \end{array}$	$\begin{array}{r} 986 \\ 342 \\ \hline \end{array}$	$\begin{array}{r} 4165 \\ 65 \\ \hline \end{array}$	$\begin{array}{r} 2054 \\ 87 \\ \hline \end{array}$	$\begin{array}{r} \$98.50 \\ 19 \\ \hline \end{array}$
7. $\begin{array}{r} 850 \\ 893 \\ \hline \end{array}$	$\begin{array}{r} 921 \\ 795 \\ \hline \end{array}$	$\begin{array}{r} 708 \\ 352 \\ \hline \end{array}$	$\begin{array}{r} 1963 \\ 38 \\ \hline \end{array}$	$\begin{array}{r} 5140 \\ 24 \\ \hline \end{array}$	$\begin{array}{r} \$30.94 \\ 58 \\ \hline \end{array}$
8. $\begin{array}{r} 908 \\ 246 \\ \hline \end{array}$	$\begin{array}{r} 789 \\ 317 \\ \hline \end{array}$	$\begin{array}{r} 635 \\ 145 \\ \hline \end{array}$	$\begin{array}{r} 3647 \\ 49 \\ \hline \end{array}$	$\begin{array}{r} 4500 \\ 71 \\ \hline \end{array}$	$\begin{array}{r} \$15.67 \\ 83 \\ \hline \end{array}$
9. $\begin{array}{r} 167 \\ 167 \\ \hline \end{array}$	$\begin{array}{r} 903 \\ 684 \\ \hline \end{array}$	$\begin{array}{r} 453 \\ 628 \\ \hline \end{array}$	$\begin{array}{r} 2705 \\ 96 \\ \hline \end{array}$	$\begin{array}{r} 9162 \\ 52 \\ \hline \end{array}$	$\begin{array}{r} \$32.04 \\ 36 \\ \hline \end{array}$

More about Multiplication

1. **Problem** In the new Lincoln High School there will be 20 classrooms. If 36 chairs are needed for each classroom, how many classroom chairs will be needed in all?

Explanation When you multiply 36 by 20 you can drop the partial product shown in A which you get when you multiply 36 by 0. It saves time to arrange the work as in B, letting the 0 of the multiplier stand out at the right. When you begin, write the 0 of 20 below the line and then multiply by 2. Now multiply 73 by 30.

A	B
36	36
20	20
00	720
72	
720	

2. **Problem** The airline distance between New York and Chicago is 713 mi. One pilot has made this flight 203 times. Find the total number of miles he has flown on this trip.

Explanation When you multiply 713 by 203 you can do the work as shown in A. But it saves time to do the work as shown in B. The partial product you get when you multiply 713 by 0 is dropped. You must be sure to place the 6 of 1426 directly under the 2 of 203 by which you multiplied.

A	B
713	713
203	203
2139	2139
000	1426
1426	144739
144739	

Check

3. One way to check multiplication is to go over your work. Another way is to change the places of the multiplicand and the multiplier and multiply again, as shown at the right.

58	34
34	58
232	272
174	170
1972	1972

Multiply. Check as shown in ex. 3 above:

4. 70 35 <u> </u>	307 241 <u> </u>	462 706 <u> </u>	400 189 <u> </u>	509 362 <u> </u>	386 508 <u> </u>
5. 90 73 <u> </u>	83 60 <u> </u>	243 204 <u> </u>	700 579 <u> </u>	206 135 <u> </u>	598 107 <u> </u>

More Practice. See 4 on page 311.



Problems

1. Mr. Brown bought a new garden tractor for \$342.50. To use with his tractor he also bought a plow for \$45.95, a power sprayer for \$108.50, and a snow blower for \$202.75. How much did he pay in all?
2. Fred has been saving the money he earns in order to buy a new bicycle that costs \$45.00. He has saved \$31.85. How much more must Fred save in order to buy the bicycle?
3. Jane took a reading test and found she could read 196 words per minute. At that rate, how many words could she read in 12 min.?
4. The airline distance from Boston to St. Louis is 1038 mi. and from Boston to Salt Lake City is 2099 mi. How much farther is it to Salt Lake City than to St. Louis?
5. During one week Jim and his father sold 60 doz. ears of sweet corn from their garden at \$.45 a dozen. How much did they get for the corn?
6. Betty will visit her grandparents during Christmas vacation. Her railroad ticket will cost \$6.47. When Betty buys her ticket, how much change should she get from a 10-dollar bill?
7. Bay City has 5 grade schools with the following numbers of pupils: 219; 342; 189; 247; 264. Find the total number of grade school pupils in Bay City.

1. Roman
ters in
books i
numera

2. Only s
number

I

1

3. The fo

Rule A.

greater

XXX =

VIII =

Rule B.

subtrac

IV = 5

IX = 1

IV may

DCCCC

Read these

4. LXIV

5. XLVI

6. CCV

7. CXII

Write these

8. 39

9. 56

10. 83

Roman Numerals

1. Roman numerals are often used today to number the chapters in books. They are also used to number the different books in a set of books. Tell some other places where Roman numerals are used.
2. Only seven letters are used in the Roman system of writing numbers. The letters have these values:

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

3. The following rules tell how to read Roman numerals:

Rule A. If the letters are alike, or if the first letter has a greater value than the second, add them.

XXX = 10 + 10 + 10, or 30 CC = 100 + 100, or 200

VIII = 5 + 1 + 1 + 1, or 8 DC = 500 + 100, or 600

Rule B. If the first letter has a smaller value than the second, subtract the first from the second.

IV = 5 - 1, or 4 XC = 100 - 10, or 90

IX = 10 - 1, or 9 CM = 1000 - 100, or 900

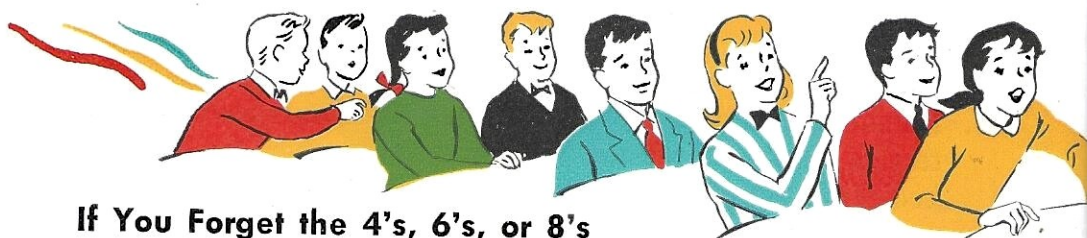
IV may also be written as IIII. CM may also be written as DCCCC.

Read these numbers:

4. LXIV	XXVI	XCIV	MDCI	MCCCL
5. XLVI	LXIX	XLIV	MCMV	MCMLX
6. CCV	MCM	CMLI	MCCC	MMXIX
7. CXII	MCC	CDXI	CDLX	LXXIX

Write these numbers, using Roman numerals:

8. 39	47	325	1892	1958	1710
9. 56	94	571	1066	1549	1877
10. 83	68	214	1450	1620	1962



If You Forget the 4's, 6's, or 8's

Sometimes you forget the answer to a multiplication fact. If the multiplication fact has a 4, or a 6, or an 8 as one of its numbers, you can easily get the answer as shown below.

1. If you forget the answer to 4×9 , take $\frac{1}{2}$ of 4, which is 2. Then find the answer for 2×9 and double it. Think, " $2 \times 9 = 18$, $2 \times 18 = 36$. So $4 \times 9 = 36$." Do the work mentally.
2. Show how to get the answer if you forget 4×7 ; 5×4 ; 9×4 . In each case begin by taking $\frac{1}{2}$ of 4.
3. If you forget the answer to 6×7 , take $\frac{1}{2}$ of 6, which is 3. Then find the answer for 3×7 and double it. Think, " $3 \times 7 = 21$, $2 \times 21 = 42$. So $6 \times 7 = 42$."
4. Show how to get the answer if you forget 6×5 ; 6×9 ; 7×6 ; 3×6 . In each case begin by taking $\frac{1}{2}$ of 6.
5. If you forget the answer to 8×7 , take $\frac{1}{2}$ of 8, which is 4. Then find the answer for 4×7 and double it. Think, " $4 \times 7 = 28$, $2 \times 28 = 56$. So $8 \times 7 = 56$." A still quicker way to think is like this: " $28, 56$. $8 \times 7 = 56$."
6. Suppose you forget the answer to 6×8 . This fact has both a 6 and an 8. In this case take $\frac{1}{2}$ of **one** of the numbers. If you take $\frac{1}{2}$ of 6, you get 3. Then find 3×8 , which is 24. Double 24, which is 48. So $6 \times 8 = 48$. You can also get the same answer by taking $\frac{1}{2}$ of 8, which is 4. Then $6 \times 4 = 24$, $2 \times 24 = 48$. So $6 \times 8 = 48$.

Suppose you forget these facts. Find the answers as shown above:

- | | | | | |
|-----------------|--------------|--------------|--------------|--------------|
| 7. 8×5 | 4×8 | 8×6 | 6×4 | 8×9 |
| 8. 7×8 | 6×6 | 5×8 | 8×8 | 9×8 |



The Mysterious 9's

- Study the 9's table at the right. When you multiply 9 by 3, you get 27. You see that the first figure of 27 is 2, which is 1 less than 3, by which you multiplied.

$2 \times 9 = 18$	$1 + 8 = 9$
$3 \times 9 = 27$	$2 + 7 = 9$
$4 \times 9 = 36$	$3 + 6 = 9$
$5 \times 9 = 45$	$4 + 5 = 9$
$6 \times 9 = 54$	$5 + 4 = 9$
$7 \times 9 = 63$	$6 + 3 = 9$
$8 \times 9 = 72$	$7 + 2 = 9$
$9 \times 9 = 81$	$8 + 1 = 9$
- When you multiply 9 by 7, you get 63. The first figure of 63 is 6, which is 1 less than 7.

In the 9's table the first figure of each answer is 1 less than the number by which 9 is multiplied.

- Look again at the answers in the 9's table. The first answer is 18; if you add 1 and 8, you get 9. The second answer is 27; if you add 2 and 7, you get 9. Add the figures in each of the other answers. Is the sum always 9?

If you know the first figure of an answer in the 9's table, you can get the second figure by adding enough to the first figure to make 9.

- Suppose you forget the answer to 8×9 . The first figure of the answer is 1 less than 8, which is 7. To get the second figure of the answer, add enough to 7 to make 9. Since 7 and 2 make 9, the second figure of the answer is 2. So $8 \times 9 = 72$. Try this plan on other 9's facts.
- If you forget 9×6 , think, "1 less than 6 is 5. 5 and 4 are 9, so the answer is 54. $9 \times 6 = 54$."

The 90 Division Facts

This is a test on the division facts. You should be able to give all the quotients orally within the time stated by the teacher:

- | | | | | | |
|----------------------|------------------|-------------------|-------------------|-------------------|-------------------|
| 1. $2\overline{)4}$ | $8\overline{)0}$ | $6\overline{)6}$ | $4\overline{)24}$ | $7\overline{)14}$ | $2\overline{)16}$ |
| 2. $1\overline{)2}$ | $4\overline{)8}$ | $1\overline{)0}$ | $7\overline{)49}$ | $3\overline{)15}$ | $6\overline{)42}$ |
| 3. $3\overline{)0}$ | $1\overline{)9}$ | $6\overline{)48}$ | $5\overline{)20}$ | $9\overline{)54}$ | $4\overline{)20}$ |
| 4. $2\overline{)8}$ | $4\overline{)4}$ | $7\overline{)63}$ | $3\overline{)18}$ | $6\overline{)36}$ | $9\overline{)27}$ |
| 5. $3\overline{)9}$ | $1\overline{)8}$ | $9\overline{)36}$ | $4\overline{)28}$ | $7\overline{)21}$ | $6\overline{)30}$ |
| 6. $1\overline{)3}$ | $2\overline{)6}$ | $5\overline{)35}$ | $7\overline{)28}$ | $9\overline{)72}$ | $3\overline{)24}$ |
| 7. $5\overline{)0}$ | $5\overline{)5}$ | $8\overline{)16}$ | $5\overline{)30}$ | $9\overline{)81}$ | $3\overline{)12}$ |
| 8. $9\overline{)9}$ | $4\overline{)0}$ | $2\overline{)18}$ | $7\overline{)42}$ | $8\overline{)40}$ | $4\overline{)16}$ |
| 9. $1\overline{)5}$ | $2\overline{)0}$ | $5\overline{)25}$ | $8\overline{)64}$ | $2\overline{)10}$ | $5\overline{)15}$ |
| 10. $6\overline{)0}$ | $3\overline{)3}$ | $2\overline{)12}$ | $8\overline{)72}$ | $6\overline{)24}$ | $8\overline{)32}$ |
| 11. $3\overline{)6}$ | $7\overline{)0}$ | $8\overline{)48}$ | $5\overline{)40}$ | $9\overline{)18}$ | $2\overline{)14}$ |
| 12. $2\overline{)2}$ | $1\overline{)6}$ | $7\overline{)35}$ | $3\overline{)21}$ | $8\overline{)24}$ | $6\overline{)54}$ |
| 13. $1\overline{)7}$ | $9\overline{)0}$ | $9\overline{)63}$ | $3\overline{)27}$ | $8\overline{)56}$ | $5\overline{)10}$ |
| 14. $7\overline{)7}$ | $8\overline{)8}$ | $4\overline{)32}$ | $6\overline{)18}$ | $4\overline{)12}$ | $7\overline{)56}$ |
| 15. $1\overline{)4}$ | $1\overline{)1}$ | $5\overline{)45}$ | $6\overline{)12}$ | $9\overline{)45}$ | $4\overline{)36}$ |

To the Teacher. See the suggestions on page 327 for giving this diagnostic test on the fundamental division facts.

Division Is Related to Multiplication

If you forget the answer to a division fact like $8\overline{)56}$, ask yourself this question: "How many 8's make 56?" If you remember the multiplication facts well, you know that seven 8's make 56. This tells you that $8\overline{)56}$ is 7.

If you did not do well on the division test on page 22, it is probably because you have not mastered the multiplication facts. If you have trouble with the division test, first turn to page 6 and multiply all the numbers on that page. Then try again the division test on page 22.

Uneven Division Facts

A division fact like $4\overline{)12}$ is called an **even** division fact because 4 divides 12 **exactly** or **evenly**. A division fact like $4\overline{)14}$ is an **uneven** division fact because 4 does not divide 14 exactly; in this case the answer is 3 with 2 left over.

Divide mentally. Give only the quotient and the amount left over. For example, in $2\overline{)7}$, say only "3 and 1 over."

- | | | | | | | |
|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1. $2\overline{)7}$ | $4\overline{)29}$ | $2\overline{)11}$ | $3\overline{)16}$ | $5\overline{)22}$ | $4\overline{)25}$ | $3\overline{)13}$ |
| 2. $7\overline{)9}$ | $3\overline{)19}$ | $6\overline{)27}$ | $4\overline{)33}$ | $2\overline{)13}$ | $7\overline{)53}$ | $4\overline{)19}$ |
| 3. $5\overline{)7}$ | $2\overline{)17}$ | $5\overline{)34}$ | $6\overline{)43}$ | $4\overline{)23}$ | $3\overline{)23}$ | $7\overline{)45}$ |
| 4. $3\overline{)8}$ | $9\overline{)74}$ | $6\overline{)20}$ | $4\overline{)13}$ | $8\overline{)75}$ | $2\overline{)19}$ | $5\overline{)39}$ |
| 5. $6\overline{)9}$ | $5\overline{)12}$ | $3\overline{)10}$ | $2\overline{)15}$ | $9\overline{)55}$ | $6\overline{)56}$ | $7\overline{)57}$ |
| 6. $3\overline{)2}$ | $4\overline{)38}$ | $8\overline{)57}$ | $6\overline{)38}$ | $7\overline{)34}$ | $5\overline{)29}$ | $6\overline{)19}$ |
| 7. $5\overline{)4}$ | $6\overline{)49}$ | $9\overline{)65}$ | $4\overline{)22}$ | $8\overline{)51}$ | $3\overline{)11}$ | $7\overline{)37}$ |
| 8. $4\overline{)3}$ | $9\overline{)20}$ | $8\overline{)65}$ | $6\overline{)31}$ | $7\overline{)65}$ | $9\overline{)82}$ | $8\overline{)43}$ |

More Practice. See 5 on page 311.

Dividing Larger Numbers

1. **Problem** The sixth grade has made 285 Christmas cards to sell at the school fair. If the cards are put into packages of 6 cards each, how many packages will there be?

Explanation Divide 285 by 6 like this:

Think, " $28 \div 6 = 4$ and 4 over."

Write 4 over the 8 of 28. Multiply 6 by 4, which gives 24. Subtract 24 from 28 and you have 4 left over. This is less than 6.

Bring down 5. Think, " $45 \div 6 = 7$ and 3 over."

Write 7 over 5. Multiply 6 by 7, which gives 42. Subtract 42 from 45. You have 3 left over. The answer is 47 and 3 over.

In the work above, 6 is the **divisor**, 285 is the **dividend**, 47 is the **quotient**, and 3 is the **remainder**.

To check division, multiply the quotient by the divisor and then add the remainder. The result should be the same as the dividend.

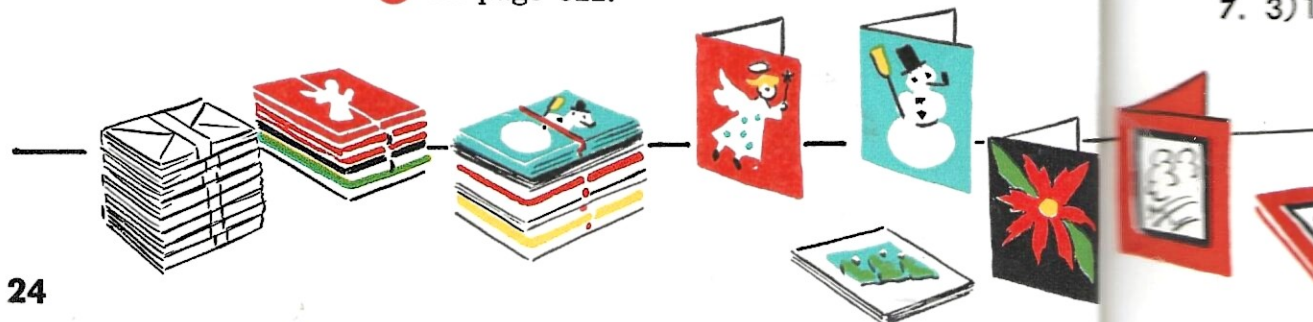
$$\begin{array}{r} \text{Quotient} \\ \text{Divisor } 6 \overline{)285} \\ \underline{24} \\ 45 \\ \underline{42} \\ 3 \text{ Remainder} \end{array}$$

$$\begin{array}{r} \text{Check} \\ 47 \\ \times 6 \\ \hline 282 \\ + 3 \\ \hline 285 \end{array}$$

Divide and check:

2. $6 \overline{)321}$	4. $3 \overline{)49}$	2. $2 \overline{)3594}$	7. $7 \overline{)6573}$	4. $4 \overline{)10956}$
3. $8 \overline{)381}$	9. $9 \overline{)238}$	5. $5 \overline{)4480}$	3. $3 \overline{)4134}$	6. $6 \overline{)16704}$
4. $6 \overline{)825}$	2. $2 \overline{)927}$	7. $7 \overline{)2705}$	9. $9 \overline{)9245}$	5. $5 \overline{)14816}$
5. $3 \overline{)795}$	4. $4 \overline{)878}$	8. $8 \overline{)9909}$	6. $6 \overline{)8574}$	9. $9 \overline{)56277}$
6. $8 \overline{)567}$	9. $9 \overline{)525}$	2. $2 \overline{)7710}$	5. $5 \overline{)3270}$	4. $4 \overline{)20304}$

More Practice. See 6 on page 311.



Dividing the Short Way

1. In division the work can be done by writing all the steps as shown below at A. The work may also be done a shorter way as shown at B. In the short way all the steps are done mentally and only the answer is written. When doing this example the short way, think, "13 divided by 3 is 4 with 1 over." Write 4 in the quotient over the 3 of 13. Think of the 1 left over as going before the 9 in the dividend, making 19. Then think, "19 divided by 3 is 6 with 1 over." Write 6 in the quotient and show the remainder by writing R1 at the right of the quotient.

A	B
$\begin{array}{r} 46 \\ 3 \overline{)139} \\ \underline{12} \\ 19 \\ \underline{18} \\ 1 \end{array}$	$\begin{array}{r} 46R1 \\ 3 \overline{)139} \end{array}$

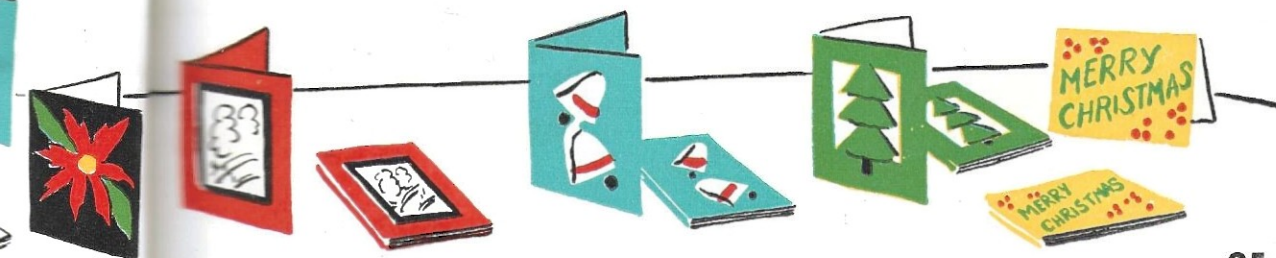
You may divide the short way if you can get correct answers easily and quickly that way. If you have difficulty with division, use the longer way and write all the steps. You may wish to use the short way only when the divisor is 2, 3, 4, or 5.

Divide the short way. Give only the answers:

- | | | | | | |
|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|
| 2. $2 \overline{)54}$ | 3. $3 \overline{)96}$ | 5. $5 \overline{)163}$ | 4. $4 \overline{)215}$ | 5. $5 \overline{)420}$ | 2. $2 \overline{)476}$ |
| 3. $2 \overline{)87}$ | 4. $4 \overline{)49}$ | 3. $3 \overline{)123}$ | 4. $4 \overline{)290}$ | 2. $2 \overline{)817}$ | 5. $5 \overline{)674}$ |
| 4. $4 \overline{)93}$ | 3. $3 \overline{)64}$ | 5. $5 \overline{)804}$ | 2. $2 \overline{)167}$ | 4. $4 \overline{)847}$ | 5. $5 \overline{)395}$ |

Divide either way. Check by multiplying:

- | | | | | |
|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|
| 5. $3 \overline{)6477}$ | 9. $9 \overline{)2785}$ | 6. $6 \overline{)4182}$ | 5. $5 \overline{)8435}$ | 9. $9 \overline{)25074}$ |
| 6. $8 \overline{)4552}$ | 2. $2 \overline{)8758}$ | 4. $4 \overline{)8750}$ | 7. $7 \overline{)6847}$ | 6. $6 \overline{)48324}$ |
| 7. $3 \overline{)1945}$ | 7. $7 \overline{)3598}$ | 8. $8 \overline{)5905}$ | 5. $5 \overline{)6545}$ | 4. $4 \overline{)21756}$ |



A Fraction in the Quotient

1. **Problem** When Tom and his family were taking an automobile trip, they traveled 104 mi. in 3 hr. How many miles per hour did they average on the trip?

Explanation When you divide 104 by 3 you have 2 left over, which has not been divided. If you divide this 2 by 3, you get $\frac{2}{3}$, and the quotient is $34\frac{2}{3}$. So Tom and his family traveled $34\frac{2}{3}$ mi. per hour on the average. What does "on the average" mean?

When you have a remainder in division, you can divide it by the divisor, getting a fraction. This fraction is a part of the quotient and is written as shown above.

2. In division problems it is not always sensible to divide the remainder to make a fraction in the quotient. In solving problems you must decide whether the remainder should be left as a remainder or written as a fraction in the quotient.
3. Helen wishes to divide 7 yd. of ribbon into 2 equal pieces. How many yards will there be in each piece?
4. Miss Brown wants to divide the 34 pupils in her room into 3 equal groups. How many will there be in each group?
5. If 1 ft. of wire costs 4¢, how many feet of this wire can be purchased for 25¢?

Divide. Write the remainder as a fraction in the quotient. Check the work by multiplying:

- | | | | | |
|-----------------------|--------------------|---------------------|---------------------|---------------------|
| 6. $2\overline{)39}$ | $4\overline{)371}$ | $6\overline{)4033}$ | $8\overline{)4511}$ | $5\overline{)3712}$ |
| 7. $4\overline{)75}$ | $2\overline{)893}$ | $7\overline{)1361}$ | $5\overline{)1780}$ | $6\overline{)2519}$ |
| 8. $7\overline{)95}$ | $9\overline{)470}$ | $5\overline{)2494}$ | $2\overline{)1695}$ | $9\overline{)3474}$ |
| 9. $6\overline{)89}$ | $5\overline{)932}$ | $4\overline{)2824}$ | $7\overline{)6070}$ | $3\overline{)2813}$ |
| 10. $3\overline{)83}$ | $7\overline{)642}$ | $8\overline{)3421}$ | $6\overline{)2310}$ | $4\overline{)2139}$ |

More Practice. See 7 on page 312.



Round Numbers

1. Andy read that each year almost 3,000,000,000 lb. of candy are produced in the United States. Andy's father told him that this number is a **round number** and that the exact number of pounds produced last year might have been a number like 2,839,476,285 lb.

A number like 2,839,476,285 is difficult to read, so it is more useful to say that the candy production in the United States last year reached **about** 3 billion pounds. When you say that 2,839,476,285 is about 3,000,000,000, you are rounding off 2,839,476,285 to the nearest billion.

2. The next billion below 3 billion is 2 billion. You see that 2,839,476,285 is much closer to 3 billion than it is to 2 billion; for this reason you say that the number of pounds was **about** 3 billion. If the number had been 2,417,063,928, you could call it about 2 billion since 2,417,063,928 is closer to 2 billion than to 3 billion.
3. The number 8271 is nearer to 8000 than it is to 9000. When you **round off** 8271 to the nearest thousand, the result is 8000. Round off 6740 to the nearest thousand. The number 436 is nearer to 400 than to 500. So 436, when rounded off to the nearest hundred, becomes 400.

4. Round off these numbers to the nearest million:

8,716,432 9,045,327 47,286,000 14,857,295

5. Round off these numbers to the nearest thousand:

3816 9493 7059 8684 6667 5275

6. Round off these numbers to the nearest hundred:

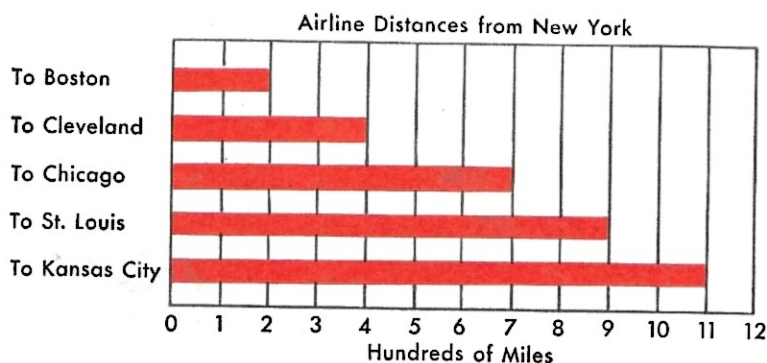
670 521 189 769 919 407

7. Round off these numbers to the nearest ten:

18 73 91 66 82 49 37 54

Bar Graphs

1. Study the bar graph below. The numbers at the bottom of the graph show distances in miles and are called the **scale**. These numbers stand for **hundreds** of miles. You see that 2 stands for 200 mi. What distance does 6 stand for?



2. The first bar above shows the approximate airline distance from New York to Boston. About how many miles is it?
3. What is the approximate distance from New York to Chicago? to Kansas City? to St. Louis? to Cleveland?
4. The actual airline distance from New York to Chicago is 713 mi. Before the graph was drawn this number was rounded off to the nearest hundred. Therefore this bar extends from 0 to 7 and shows that the approximate distance from New York to Chicago is 700 mi.
5. The actual distances from New York to the other cities are as follows: Boston, 188 mi.; Cleveland, 405 mi.; St. Louis, 875 mi.; Kansas City, 1097 mi. Round off each of these numbers to the nearest hundred. Then see if the bars in the above graph are the right length.
6. The airline distances from Chicago to these cities are as follows: Cleveland, 308 mi.; Kansas City, 414 mi.; Washington, 597 mi.; Philadelphia, 666 mi.; Salt Lake City, 1260 mi. Draw a bar graph to show these distances. Before drawing the graph round off the numbers to the nearest hundred.

Two-Figure Divisors

1. **Problem** An airplane pilot flew 7290 mi. in 31 hr. How many miles per hour, on the average, did he fly?

Explanation You must divide 7290 by 31.

The first partial dividend is 72. To estimate the first quotient figure, divide 7 by 3. This gives 2, which you write over the 2 of 72. Multiply 31 by 2, which gives 62. Subtract 62 from 72, which gives a remainder of 10. Compare the remainder with the divisor. Since 10 is less than 31, the quotient figure 2 is right. **The remainder must**

always be less than the divisor. Bring down 9, which makes the next partial dividend 109. You repeat these steps to find the other two quotient figures.

The quotient is 235 with a remainder of 5. The pilot flew about 235 miles per hour, on the average.

To check the work multiply 235 by 31 and add the remainder 5. The result should equal the dividend 7290.

	235	Check
31	$\overline{)7290}$	235
	62	31
	$\overline{)109}$	235
	93	705
	$\overline{)160}$	7285
	155	5
	$\overline{)5}$	7290

When a two-figure divisor ends in 1, 2, 3, 4, or 5, divide by the first figure of the divisor to estimate each figure of the quotient.

Divide and check:

✓ 2. $42 \overline{)1596}$	$52 \overline{)1887}$	$81 \overline{)26659}$	$54 \overline{)39126}$
✓ 3. $32 \overline{)1472}$	$73 \overline{)1931}$	$93 \overline{)34782}$	$22 \overline{)13799}$
✓ 4. $62 \overline{)3538}$	$43 \overline{)3554}$	$71 \overline{)34245}$	$91 \overline{)38886}$
✓ 5. $31 \overline{)1928}$	$92 \overline{)5262}$	$41 \overline{)29732}$	$72 \overline{)41256}$

More Practice. See 8 on page 312.

Correcting Quotient Figures

1. **Problem** The school lunchroom served 1708 lunches during the 23 school days in March. How many lunches were served on the average each school day in March?

Explanation You divide 17 by 2 to estimate the first quotient figure, getting 8. When you multiply 23 by 8 you get 184, which is too large to be subtracted from 170. Try 7, which is one less than 8. When you multiply 23 by 7 you get 161, which can be subtracted from 170. Is the remainder less than the divisor? Bring down 8, which gives 98 as the next partial dividend. When you divide 9 by 2 you get 4 as the next quotient figure. Why is 4 right?

$$\begin{array}{r} 8 \\ 23 \overline{)1708} \\ \underline{184} \\ 74 \\ 23 \overline{)1708} \\ \underline{161} \\ 98 \\ \underline{92} \\ 6 \end{array}$$

The quotient is 74 with a remainder of 6. The school lunchroom served about 74 lunches per day during March.

2. **Problem** Divide 1807 by 24.

Explanation When you divide 18 by 2 to estimate the first quotient figure, you get 9. This figure is too large since 9×24 is larger than 180. When you try 8 you find that it also is too large. Why? Why is 7 right? Explain how the second quotient figure is found.

$$\begin{array}{r} 75 \\ 24 \overline{)1807} \\ \underline{168} \\ 127 \\ \underline{120} \\ 7 \end{array}$$

When the quotient figure is too large, try the next smaller figure.

Divide and check:

- | | | | |
|--------------------------|-----------------------|-----------------------|------------------------|
| 3. $32 \overline{)1880}$ | 93 $\overline{)6301}$ | 63 $\overline{)4280}$ | 53 $\overline{)28502}$ |
| 4. $23 \overline{)1604}$ | 62 $\overline{)3904}$ | 53 $\overline{)2098}$ | 83 $\overline{)65813}$ |
| 5. $43 \overline{)3220}$ | 34 $\overline{)2702}$ | 54 $\overline{)2048}$ | 62 $\overline{)18348}$ |
| 6. $32 \overline{)1843}$ | 25 $\overline{)1965}$ | 21 $\overline{)1215}$ | 44 $\overline{)36400}$ |

More Practice. See 9 on page 312.



1. A
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2. Ea
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3. La
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4. In
th
- Divide
5. 51
6. 34
7. 73
8. 25
9. 23
10. 75
11. 31

es during
re served

$$\begin{array}{r} 8 \\ 23 \overline{)1708} \\ \underline{184} \end{array}$$

$$\begin{array}{r} 74 \\ 23 \overline{)1708} \\ \underline{161} \\ 98 \\ \underline{92} \\ 6 \end{array}$$

e school
March.

$$\begin{array}{r} 75 \\ 24 \overline{)1807} \\ \underline{168} \\ 127 \\ \underline{120} \\ 7 \end{array}$$

he next

$$\begin{array}{r} \overline{)28502} \end{array}$$

$$\begin{array}{r} \overline{)65813} \end{array}$$

$$\begin{array}{r} \overline{)18348} \end{array}$$

$$\begin{array}{r} \overline{)36400} \end{array}$$



Problems and Practice

1. A streamlined train makes a trip of 1254 mi. in 22 hr. How many miles per hour does it average?
2. Each coach of the train has seats for 54 passengers. How many coaches will be needed for 800 passengers if each one is to have a seat?
3. Last summer Mr. Field drove his family 4070 mi. in 22 da. How many miles on the average did he drive a day?
4. In one year Mr. Field drove his car 17,836 mi. What was the average number of miles he drove per week?

Divide and check. Use the rule on page 29 to find the quotient figures:

- | | | | |
|---------------------------|-------------------------|--------------------------|--------------------------|
| 5. $51 \overline{)8313}$ | 24. $51 \overline{)84}$ | 72. $23 \overline{)623}$ | 53. $29 \overline{)862}$ |
| 6. $34 \overline{)8942}$ | 62. $40 \overline{)57}$ | 33. $32 \overline{)109}$ | 64. $18 \overline{)048}$ |
| 7. $73 \overline{)6716}$ | 92. $90 \overline{)16}$ | 60. $37 \overline{)260}$ | 42. $55 \overline{)692}$ |
| 8. $25 \overline{)9150}$ | 32. $68 \overline{)80}$ | 55. $15 \overline{)912}$ | 71. $50 \overline{)978}$ |
| 9. $23 \overline{)9695}$ | 61. $78 \overline{)08}$ | 52. $43 \overline{)316}$ | 45. $20 \overline{)846}$ |
| 10. $75 \overline{)7200}$ | 83. $79 \overline{)36}$ | 40. $28 \overline{)657}$ | 54. $19 \overline{)818}$ |
| 11. $31 \overline{)9998}$ | 65. $30 \overline{)55}$ | 74. $27 \overline{)602}$ | 85. $35 \overline{)647}$ |

More Two-Figure Divisors

1. **Problem** Last fall 29 Boy Scouts collected 15,291 lb. of old newspapers for the used paper drive. How many pounds on the average did each Boy Scout collect?

Explanation You need to divide 15,291 by 29.

Since 29 is closer to 30 than to 20, use 3 as the trial divisor instead of 2. To estimate the first quotient figure, divide 15 by 3, which gives 5. Multiply 29 by 5, getting 145, and subtract 145 from 152. The remainder 7 is less than the divisor 29, so 5 is right. Bring down 9, making the second partial dividend 79.

By what do you divide 7 to estimate the second quotient figure? Does this give the right quotient figure? Why? Explain how to find the third quotient figure.

The quotient is 527 with a remainder of 8. Each Boy Scout collected on the average a little more than 527 lb.

$$\begin{array}{r} 527 \\ 29 \overline{)15291} \\ \underline{145} \\ 79 \\ \underline{58} \\ 211 \\ \underline{203} \\ 8 \end{array}$$

When a two-figure divisor ends in 6, 7, 8, or 9, divide by 1 more than the first figure of the divisor to estimate each quotient figure.

2. What do you use as the trial divisor when the divisor is 39? 67? 58? 46? 37? 97?

Divide and check:

3. $26 \overline{)1221}$

$39 \overline{)1037}$

$28 \overline{)12310}$

$49 \overline{)14443}$

4. $37 \overline{)2013}$

$79 \overline{)4103}$

$38 \overline{)16332}$

$67 \overline{)23304}$

5. $28 \overline{)2434}$

$38 \overline{)1801}$

$29 \overline{)17233}$

$79 \overline{)38893}$

6. $27 \overline{)2131}$

$49 \overline{)1890}$

$57 \overline{)48277}$

$39 \overline{)36170}$

More Practice. See 10 on page 313.

Watching the Remainder

1. **Problem** When George's family took an automobile trip of 442 mi. they used 26 gal. of gasoline. How many miles did they travel on the average with 1 gal. of gasoline?

Explanation Tell how to get the first quotient figure when you divide 442 by 26.

To estimate the second quotient figure you divide 18 by 3, getting 6. Using 6 as the quotient figure, you get a remainder of 26, which is **equal** to the divisor. This shows that the quotient figure should be 7 instead of 6, since the remainder 26 will contain 26 once. The remainder must always be less than the divisor.

The quotient is 17. George's family traveled an average of 17 mi. on 1 gal. of gasoline.

$$\begin{array}{r} 16 \\ 26 \overline{) 442} \\ \underline{26} \\ 182 \\ \underline{156} \\ 26 \end{array}$$

$$\begin{array}{r} 17 \\ 26 \overline{) 442} \\ \underline{26} \\ 182 \\ \underline{182} \\ 0 \end{array}$$

When the remainder is equal to or larger than the divisor, try the next larger figure as the quotient figure.

2. How were the quotient figures below found? Why are they wrong? Copy each example, correct the first quotient figure, and finish the work:

$$\begin{array}{r} 8 \\ 27 \overline{) 2501} \\ \underline{216} \\ 34 \end{array}$$

$$\begin{array}{r} 6 \\ 48 \overline{) 3485} \\ \underline{288} \\ 60 \end{array}$$

$$\begin{array}{r} 7 \\ 36 \overline{) 30564} \\ \underline{252} \\ 53 \end{array}$$

$$\begin{array}{r} 7 \\ 26 \overline{) 23816} \\ \underline{182} \\ 56 \end{array}$$

Divide and check:

3. $38 \overline{) 3192}$

$27 \overline{) 1701}$

$46 \overline{) 4278}$

$29 \overline{) 23896}$

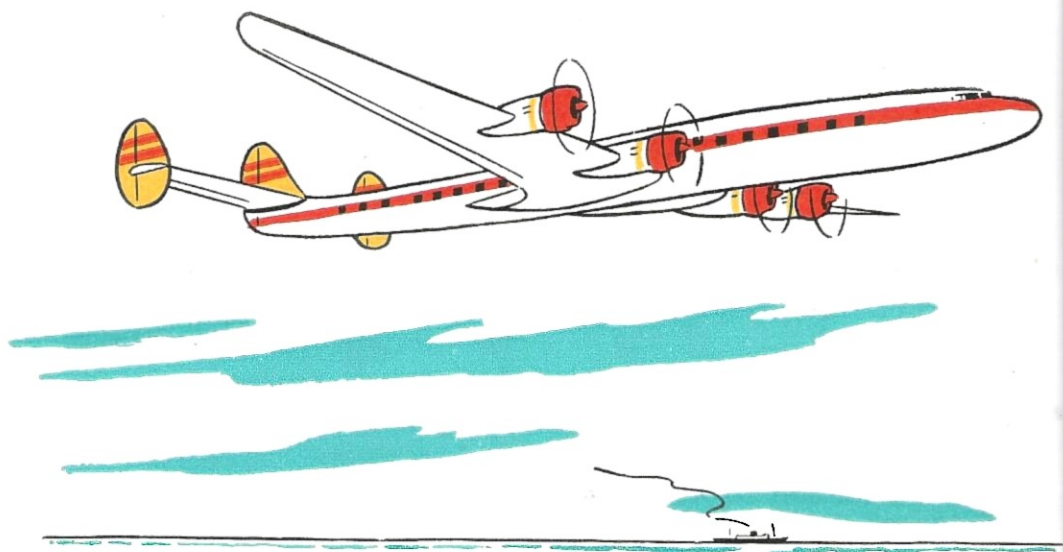
4. $48 \overline{) 1395}$

$66 \overline{) 4686}$

$26 \overline{) 1915}$

$36 \overline{) 34101}$

More Practice. See 11 on page 313.



Problems and Practice

1. An airliner made an overseas flight of 6102 mi. in 27 hr. How many miles per hour did it average?
2. Mr. King bought 28 radios to sell in his store. He paid \$975.80 in all. What was the average cost per radio?
3. Mr. King also bought 19 television sets at a total cost of \$3762. What was the average cost per television set?
4. On a holiday 36 busses carried 1548 passengers to Ocean City. What was the average number of passengers per bus?

Divide. Check your work by multiplying:

- | | | | |
|---------------------------|-----------------------|------------------------|------------------------|
| 5. $28 \overline{)7868}$ | 48 $\overline{)6096}$ | 29 $\overline{)51417}$ | 37 $\overline{)69227}$ |
| 6. $19 \overline{)9942}$ | 27 $\overline{)3078}$ | 88 $\overline{)69168}$ | 49 $\overline{)60466}$ |
| 7. $39 \overline{)7119}$ | 58 $\overline{)8294}$ | 36 $\overline{)66038}$ | 59 $\overline{)20736}$ |
| 8. $46 \overline{)9982}$ | 19 $\overline{)8873}$ | 67 $\overline{)52637}$ | 78 $\overline{)87594}$ |
| 9. $67 \overline{)2601}$ | 86 $\overline{)8428}$ | 47 $\overline{)60301}$ | 69 $\overline{)78798}$ |
| 10. $26 \overline{)8115}$ | 57 $\overline{)9234}$ | 77 $\overline{)50992}$ | 38 $\overline{)27181}$ |

Zeros in the Quotient

1. Study the examples below and tell how each quotient figure was found. Copy each dividend and divisor and divide:

$$\begin{array}{r} 730 \\ 29 \overline{) 21170} \\ \underline{203} \\ 87 \\ \underline{87} \\ 0 \end{array}$$

Check

$$\begin{array}{r} 730 \\ 29 \\ \hline 6570 \\ 1460 \\ \hline 21170 \end{array}$$

$$\begin{array}{r} 704 \text{ R}24 \\ 73 \overline{) 51416} \\ \underline{511} \\ 316 \\ \underline{292} \\ 24 \end{array}$$

Check

$$\begin{array}{r} 704 \\ 73 \\ \hline 2112 \\ 4928 \\ \hline 51392 \\ 24 \\ \hline 51416 \end{array}$$

$$\begin{array}{r} 2008 \text{ R}21 \\ 38 \overline{) 76325} \\ \underline{76} \\ 325 \\ \underline{304} \\ 21 \end{array}$$

Check

$$\begin{array}{r} 2008 \\ 38 \\ \hline 16064 \\ 6024 \\ \hline 76304 \\ 21 \\ \hline 76325 \end{array}$$

Divide and check. Write R before the remainder:

- | | | |
|---------------------|------------------|-------------------|
| 2. $76,152 \div 38$ | 34,046 $\div$ 37 | 648,818 $\div$ 81 |
| 3. $12,896 \div 62$ | 26,250 $\div$ 25 | 325,272 $\div$ 39 |
| 4. $15,910 \div 76$ | 22,571 $\div$ 46 | 450,675 $\div$ 75 |
| 5. $11,880 \div 22$ | 72,192 $\div$ 24 | 236,070 $\div$ 58 |
| 6. $96,192 \div 32$ | 54,820 $\div$ 27 | 103,375 $\div$ 34 |
| 7. $36,000 \div 48$ | 19,162 $\div$ 93 | 152,304 $\div$ 19 |

8. Last year Mr. Peck drove his car 20,285 mi. Find the average number of miles he drove per week.
9. In the last 19 mo. Jim has earned \$381.71. What is the average amount he has earned per month?
10. To make money to buy new suits for the ball team, 89 boys sold 9345 lb. of old paper. On the average, about how many pounds of paper did each boy sell?

Oral Practice

Divide each number by 4. Divide each by 5:

- | | | | | | | | |
|-------|----|----|----|----|----|----|---|
| 1. 20 | 48 | 32 | 29 | 33 | 45 | 19 | 8 |
| 2. 13 | 25 | 41 | 17 | 37 | 28 | 31 | 3 |

Divide mentally:

- | | | | | | |
|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 3. $5 \overline{)105}$ | $4 \overline{)168}$ | $2 \overline{)480}$ | $9 \overline{)459}$ | $7 \overline{)567}$ | $4 \overline{)364}$ |
| 4. $3 \overline{)693}$ | $8 \overline{)560}$ | $6 \overline{)186}$ | $5 \overline{)300}$ | $3 \overline{)906}$ | $2 \overline{)682}$ |
| 5. $4 \overline{)172}$ | $2 \overline{)196}$ | $5 \overline{)290}$ | $3 \overline{)255}$ | $2 \overline{)134}$ | $4 \overline{)300}$ |

6. In the example, $637 \div 24 = 26 \text{ R}13$, tell the name of 637, of 24, of 26, of 13.

Estimate each quotient:

- | | | | |
|------------------|---------------|---------------|---------------|
| 7. $175 \div 42$ | $490 \div 61$ | $440 \div 55$ | $375 \div 73$ |
| 8. $210 \div 69$ | $100 \div 36$ | $132 \div 28$ | $312 \div 47$ |

Written Practice

Divide and check. Write any remainder as a fraction in the quotient:

- | | | | | |
|----------------------|------------------|-------------------|--------|---------|
| 9. $25,792 \div 32$ | $30,258 \div 41$ | $118,569 \div 26$ | | |
| 10. $32,307 \div 85$ | $35,364 \div 28$ | $116,181 \div 39$ | | |
| 11. $15,235 \div 18$ | $33,633 \div 37$ | $506,846 \div 63$ | | |
| 12. $75,497 \div 54$ | $34,500 \div 46$ | $231,245 \div 35$ | | |
| 13. $12,529 \div 67$ | $11,995 \div 23$ | $373,837 \div 89$ | | |
| 14. $58,870 \div 29$ | $37,431 \div 58$ | $453,546 \div 74$ | | |
| 15. Divide by 19: | 4579 | 16,214 | 13,243 | 110,175 |
| 16. Divide by 25: | 1128 | 15,511 | 23,450 | 104,775 |
| 17. Divide by 57: | 1547 | 11,725 | 84,075 | 342,513 |

Using Measures

1. Last summer Bill was at camp for 2 wk. and 4 da. This summer he will go to camp for 4 wk. How many more days will Bill be at camp this summer than last?
2. Mrs. Hood saw two boxes of cookies in a store. One box was marked "1 lb. 2 oz." The other box of cookies was marked "10 oz." Which box held more ounces of cookies and how many ounces more did it hold?
3. Mary's mother made 145 cookies and Mary sold them by the dozen. How many dozen cookies were there? Were any cookies left over?
4. Mary sold the cookies at 40¢ a dozen. How much did she get for $\frac{1}{2}$ doz. cookies? for $\frac{3}{4}$ doz. cookies?
5. John needs 32 yd. of wire netting for a fence around his garden. The netting is sold in rolls, each containing 100 ft. of netting. How many rolls does John need?
6. Ted sold 320 half-pint containers of ice cream at 15¢ each. How many quarts of ice cream would this be? How many gallons? How much did Ted get for the ice cream? At this rate, how much would 1 gal. cost?

Tell the number that goes in each space:

- | | | |
|-------------------------------|----------------------------|-----------------------------|
| 7. 6 ft. = ? yd. | $\frac{1}{4}$ yd. = ? in. | 45 min. = ? hr. |
| 8. 6 mo. = ? yr. | 3 hr. = ? min. | 12 gal. = ? qt. |
| 9. $\frac{1}{2}$ bu. = ? pk. | $\frac{3}{4}$ hr. = ? min. | 45 sec. = ? min. |
| 10. $\frac{1}{2}$ yd. = ? in. | 2 qt. = ? gal. | 24 qt. = ? gal. |
| 11. 2 lb. = ? oz. | 9 ft. = ? yd. | $\frac{1}{2}$ min. = ? sec. |
| 12. $\frac{1}{4}$ bu. = ? qt. | 8 qt. = ? gal. | $\frac{1}{2}$ ton = ? lb. |
| 13. 6 yd. = ? ft. | $\frac{1}{2}$ hr. = ? min. | 12 pt. = ? qt. |
| 14. 4 oz. = ? lb. | 3 yr. = ? mo. | $\frac{1}{2}$ gal. = ? qt. |
| 15. 1 mi. = ? ft. | $\frac{3}{4}$ yd. = ? in. | 28 da. = ? wk. |



Problems

1. One Saturday four boys sold vegetables from their gardens. When the vegetables were sold, the boys had a total of \$14.72. If the boys shared the money equally, what was each boy's share?
2. Jane bought a schoolbag for \$2.50, a ball-point pen for \$1.25, a pencil for \$.85, and a notebook for \$.25. How much did all these things cost?
3. Andy and his father drove 225 mi. to Little Falls. It took them 7 hr. to make this trip. About how many miles per hour did they average?
4. When Mr. Smith sends blueberries to market he puts 24 pint boxes in one case. How many cases will he need for 600 pint boxes of blueberries?
5. This week Mrs. Wood paid Betty \$2.75 for baby-sitting. Betty told Jean that was \$.75 less than she earned last week. How much did Betty earn last week?
6. Patty's new winter coat cost \$19.79. It had been marked down from \$27.50. How much money did Patty save?
7. Jim opened 15 cases of canned soup and put the cans on shelves in the store. There were 24 cans in each case. How many cans of soup did Jim put on shelves?
8. Peter gave the clerk in the grocery store \$5.00 to pay for groceries that cost \$3.17 all together. How much change did the clerk give Peter?

Problems without Questions

The problems on this page are not complete because no question has been asked. Make a good question for each problem, using all the facts that are given. Then find the answer:

1. Jim bought a suit for \$14.95. It had been marked down from \$18.50.
2. Mary earned \$9.75 baby-sitting for Mrs. Wood and \$6.35 going on errands for Miss Williams.
3. George bought a fountain pen that cost \$4.85. He gave the clerk \$10.00 to pay for it.
4. Betty had 85¢ to buy picture post cards. The cards cost 7¢ apiece.
5. Mr. Johnson used 67 gal. of gasoline last month. He drove his car 1206 mi. on that amount of gasoline.
6. Jack got 7¢ for every ice cream cone he sold at the ball game. All together he sold 429 cones.
7. A party for 35 pupils and teachers cost \$15.05.
8. Patty is 3 in. taller than her sister Mary Ann. Mary Ann is 59 in. tall.
9. There are 11,612 persons living in Grandview this year. This is 385 persons more than there were last year.
10. Jim wants to save \$15.00 to use for Christmas presents. He has saved \$8.45 so far.
11. A train averages 59 mi. an hour. It makes a trip of 475 mi. from Cape May to Danbury.
12. It costs Peter 48¢ a day for his lunch at school and his bus fare. Peter went to school every one of the 23 days of school last month.
13. It took Mr. West 6 hr. to drive his car 234 mi.
14. The train due to arrive in Boston at 6:39 P.M. did not arrive until 7:14 P.M.

Chapter Review

1. Alice read that Mt. Washington is 6288 ft. high. Is Mt. Washington more than a mile high? If so, how much more than a mile high is it?
2. Mrs. Chase spent \$128.65 for food for her family during the month of July. How much did she spend per day, on the average, for food?
3. Jim started to rake leaves at 9:20 A.M. He stopped at 11:05 A.M. How long did Jim rake leaves?
4. How many minutes is it from 4:45 P.M. to 6:03 P.M.?
5. Find the product of 9406 and 87.
6. How much more is \$400.00 than \$263.78?
7. Find the sum of 2736, 487, 5129, and 2639.
8. Find the remainder if you divide 13,091 by 49.
9. Find the difference between 46,789 and 83,353.
10. Read these Roman numbers: LXXVI, MDCCI, XLIV, MCM, DCX, XCVII, MM, CCIX.
11. Write these numbers in Roman numerals: 48, 65, 83, 96, 204, 1492, 1600, 1725, 1959, 2035.
12. Write these numbers in figures: Twenty-six thousand two hundred forty-six; eight hundred thousand; thirty million eighty; two billion seven million five hundred fifty-two thousand.
13. Round off each number to the nearest hundred:
937 481 995 621 389 142
14. Round off each number to the nearest thousand:
1864 4129 5096 3979 8907
15. Round off 5096 to the nearest hundred.
16. Round off each number to the nearest ten-thousand:
42,943 86,099 15,358 54,832 11,436

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A Problem Test

1. Bill counted all the ticket money the sixth grade pupils handed in. He had 52 one-dollar bills, 15 half dollars, 47 quarters, 88 dimes, 19 nickels, and 20 pennies. If the tickets sold for 35¢ each, how many tickets had been sold?
2. Mr. Wood filled the tank of his car with 17 gal. of gasoline. Find the cost of the gasoline at \$.26 a gallon.
3. Ann bought a sweater for \$3.95. How much change did she get from \$10.00?
4. Betty paid \$11.00 for 4 yd. of cloth for a new suit. What was the price of the cloth per yard?
5. At a book sale 438 books were sold at \$1.95 apiece. How much money did all these books bring in?
6. Mr. Stone can average 39 mi. an hour when he drives on long trips. About how many hours of driving does he need for a trip of 665 mi.?
7. Peter spent \$1.79 for a shirt, \$15.50 for a suit, \$.50 for a tie, \$.57 for socks, \$1.69 for gloves, and \$5.95 for shoes. How much in all did Peter spend?
8. For new pillow covers, curtains, and a bedspread Susan needs 648 in. of material. How many yards of material should she buy?
9. Jim needs \$95.00 for his vacation at camp next summer. He has saved \$67.35 so far. How much more money does Jim need to save?
10. At the beach a small cottage can be rented for \$49.50 a week. What is the rent of this cottage for 6 wk.?

How many problems did you get right? Look below to find out what your score means.

SCORE	0-5	6-7	8-9	10
	You need help	Fair	Good	Excellent

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Add and check:

Practice
Pages

1. 146	845	156	968	376
672	989	692	171	509
759	417	526	420	482
283	983	384	407	571
<u>314</u>	<u>755</u>	<u>627</u>	<u>819</u>	<u>248</u>

9

2. 3536	4715	1485	4382	3065
4658	7863	8276	6644	656
1943	935	6533	3600	274
<u>2206</u>	<u>1487</u>	<u>773</u>	<u>3579</u>	<u>3705</u>

9

Subtract and check:

3. 5402	5325	60001	90258
<u>3865</u>	<u>4695</u>	<u>28423</u>	<u>63699</u>

13

4. 4367	7674	43817	60000
<u>2369</u>	<u>4837</u>	<u>16325</u>	<u>39753</u>

13

Multiply and check:

5. 259	956	673	1549	4817
<u>239</u>	<u>481</u>	<u>257</u>	<u>76</u>	<u>83</u>

16

6. 928	846	738	952	437
<u>407</u>	<u>905</u>	<u>106</u>	<u>560</u>	<u>290</u>

17

Divide and check:

7. 44 $\overline{)1993}$	63 $\overline{)4227}$	21 $\overline{)15498}$
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29, 30

8. 28 $\overline{)4166}$	56 $\overline{)12158}$	78 $\overline{)71994}$
--------------------------	------------------------	------------------------

32, 33

9. 52 $\overline{)10875}$	29 $\overline{)116174}$	45 $\overline{)273611}$
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35

Chapter 2



The Golden Gate Bridge

1. San Francisco has a very large bay which is one of the world's greatest harbors. The channel which connects the bay with the Pacific Ocean is called the Golden Gate. In 1937 a beautiful suspension bridge crossing the Golden Gate was completed. How many years ago was that?
2. A suspension bridge is one which has its roadway suspended from huge cables that pass over high towers at each end of the bridge. The distance between the towers is called the central span of the bridge. In the picture above, point to the towers, the cables, the central span, and the roadway.
3. The Golden Gate Bridge has the longest central span of any bridge in the world. This span is 4200 ft. long. How much less than a mile is the central span? 1 mi. = 5280 ft.
4. The two great steel towers are each 746 ft. high. If a building were 746 ft. high, how many stories would it have if 12 ft. were allowed for each story?

The Golden Gate Bridge

1. The Golden Gate Bridge is made up of three parts. The longest part is the central span which is 4200 ft. long. There are also two end spans, each 1125 ft. long. Each end span is the part between the shore and the tower. Counting these three parts, how many feet long is the entire bridge? Is the length of the bridge more or less than $1\frac{1}{4}$ mi.?
2. The Golden Gate Bridge has the highest span of any suspension bridge in the world. The roadway or floor of the bridge is 220 ft. above the water at high tide and 236 ft. above at low tide. The steamship *Queen Mary* measures 204 ft. from her water line to the top of her tallest mast. This ship could safely sail under the Golden Gate Bridge and have how many feet to spare at high tide? how many feet to spare at low tide?
3. Each of the cables that support the floor of the bridge was made up of 27,572 wires which were squeezed together as tightly as possible and then covered. When each cable was finished, it had a diameter of 3 ft. Draw a circle on the board with a diameter of 3 ft. to show how big each cable is.
4. During a recent year 15,161,487 cars and trucks passed over the Golden Gate Bridge. This was an average of how many cars and trucks per month? Round off 15,161,487 to the nearest million before finding the average.
5. If the average charge was 50¢ for each car or truck that crossed the bridge, how much money was collected, on the average, per month? Use the answer to ex. 4.
6. The first great suspension bridge to be built was the famous Brooklyn Bridge, completed in 1883, which connects Brooklyn with New York. This bridge is still in use. For how many years has the Brooklyn Bridge been used? The central span of the Brooklyn Bridge is 1595 ft., while that of the Golden Gate Bridge is 4200 ft. Is the central span of the Brooklyn Bridge less than one half that of the Golden Gate Bridge? If so, how many feet less is it?

Keeping Accounts

- Mary is the treasurer of her club. Each of the 19 members of the club pays dues of 10¢ a month. Mary collects the dues and keeps an **account** of the money she receives. She also pays out money for the club and enters it in the account. During September the club held a candy sale. Here is Mary's account for the month of September:

Money Received				Money Paid Out			
Sept. 7	Dues	1	40	Sept. 19	Sugar		49
Sept. 14	Dues		50		Chocolate		51
Sept. 22	Candy sale	4	80	Sept. 21	Milk		23
					Butter		34
				Sept. 22	Paper bags		10
				Sept. 30	Cash on hand	5	03
	Total	6	70			6	70
Sept. 30	Cash on hand	5	03				

- In September Mary received a total of \$6.70 and spent a total of \$1.67. Study the account and explain each of the amounts entered in it.
- When Mary subtracts \$1.67 from \$6.70 she finds that she should have \$5.03 left in cash. \$5.03 is called the **cash on hand**. Mary counts her cash and finds that she really has \$5.03 left, so she writes "Cash on hand, \$5.03" on the right side of the account and adds that side. The sum is \$6.70; the account **balances** because both sides give a total of \$6.70. Mary draws double lines under \$6.70 on both sides to show that the account above these lines is correct. She then starts a new account, writing "Cash on hand, \$5.03" on the left side under \$6.70.
- If Mary does not have the right amount of cash on hand to make her account balance, she may have forgotten to write down some amounts that she spent. If Mary had forgotten to write down the \$.10 for paper bags, what would happen when she tried to balance her account? What would happen if she forgot to enter some dues she had received?



Jack's Cash Book

1. Jack keeps an account of all the money he receives and spends. His account for one week is shown below:

Money Received				Money Paid Out			
Oct. 2	Cash on hand	1	85	Oct. 3	Club dues		15
Oct. 3	Cleaning yard		50	Oct. 5	Movies		35
Oct. 6	Washing car		75	Oct. 7	Football	2	59
Oct. 7	Allowance		75	Oct. 9	Cash on hand		

2. Balance Jack's account and tell how much cash he ought to have on hand on Oct. 9.
3. When Jack counted his cash on Oct. 9 he had only \$.61 on hand. How much cash was he short? Then he remembered that he spent \$.15 for candy on Oct. 6 and forgot to write it down. Will his account balance now?
4. The next week Jack's account showed these items on the "Received" side: Oct. 9, \$.61 cash on hand; Oct. 10, \$.25 for running an errand; Oct. 12, \$.85 for helping at the store; Oct. 14, \$.75 for allowance; Oct. 15, \$.35 for raking leaves. These items were on the "Paid Out" side: Oct. 10, \$.30 for bus fare; Oct. 10, \$.25 for lunch; Oct. 12, \$.75 for birthday gift; Oct. 13, \$.25 for notebook; Oct. 14, \$.12 for stamps. Write Jack's cash account for that week and balance it.

1. A book receive for you those
2. At the do this side of sides o ances, alike, any m in your in the enter p
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4. Here is cash of old pa paid o Nov. 5 Bob's balance
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raking leaves.
10, \$.30 for
for birthday
for stamps.
balance it.

Keeping Cash Accounts

1. A book in which you keep an account of the money you receive and spend is called a **cash book**. Make a cash book for your own use by drawing lines on a sheet of paper like those in Jack's account on page 46.
2. At the end of the week see if your account balances. To do this, count your cash on hand and enter it on the right side of your cash book. Then add the numbers on both sides of the book. If the sums are alike, your account balances, which means that it is correct. If the sums are not alike, the account is incorrect. In this case, try to think of any money you received or spent that you forgot to enter in your cash book. If you remember such items, write them in the book and then see if the account balances. Always enter promptly any money you receive or spend.
3. On a sheet of paper draw lines for an account and enter these items as "Received": Oct. 9, \$.85 cash on hand; Oct. 10, \$1.50 for baby-sitting; Oct. 11, \$.25 for delivering cookies; Oct. 15, \$1.00 for allowance; Oct. 15, \$.45 for selling used book. Also enter these items as "Paid Out": Oct. 11, \$.30 for movies; Oct. 13, \$.35 for lunch; Oct. 13, \$.95 for present for Mother; Oct. 14, \$1.75 put in bank; Oct. 15, \$.05 for pencil; Oct. 15, \$.35 for lunch. Then balance the account. How much cash ought you to have on hand on Oct. 16?
4. Here is Bob's account for a week. Money received: Nov. 1, cash on hand, \$1.15; Nov. 1, allowance, \$1.00; Nov. 4, for old paper, \$.65; Nov. 6, for raking leaves, \$.75. Money paid out: Nov. 2, notebook, \$.19; Nov. 3, ice cream, \$.15; Nov. 5, ball-point pen, \$.95; Nov. 6, movies, \$.30. Nov. 8, Bob's cash on hand was \$1.96. Make out the account and balance it.
5. Make up a problem like ex. 4, showing Ann's account for a week. Tell the amounts she received, giving the date for each item. Also tell the amounts spent with the date for each. Make out the account and balance it.

Hidden Questions in Problems



1. **Problem** Jim wants to buy a new camera that costs \$9.75. He has already saved \$4.65 toward the cost. If he can save \$.85 a week, how many weeks will it take him to save the rest of the money for the camera?

Explanation This is a two-step problem.

First Step. In this step you have to answer this question: How much more money must Jim save? To find out, subtract \$4.65 from \$9.75, which gives \$5.10. Jim still has to save \$5.10.

The question you have just answered is, "How much more money must Jim save?" This is called the **hidden** question because it is not asked in the problem. When you read the problem you have to find this hidden question and answer it before you can work the second step.

Second Step. You are now ready to answer the question asked in the problem, which is: "How many weeks will it take him to save the rest of the money?" To find out, divide \$5.10, the amount Jim must still save, by \$.85, the amount he can save in a week. Write \$5.10 as 510¢ and \$.85 as 85¢, as shown at the right. It will take Jim 6 weeks to save the rest of the money for the camera.

$$\begin{array}{r} 6 \\ 85 \overline{) 510} \\ \underline{510} \end{array}$$

In each of these problems below there is a hidden question. Find the hidden question, answer it, and then answer the question asked in the problem:

2. Jean bought 6 handkerchiefs at \$.39 apiece. How much change did she get from \$5.00?
3. Ted took 3 friends to the movies. He bought 4 tickets at \$.65 each and paid \$.60 for ice cream afterwards. How much in all did Ted spend?
4. For a school party Miss Field ordered 20 qt. of ice cream at \$2.15 a gallon. How much did the ice cream for the party cost?



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Two-Step Problems

1. Mrs. Johnson buys 3 qt. of milk each day at \$.21 a quart. What was the amount of her milk bill for November?
2. Bob is saving to buy a wrist watch that costs \$14.25. He saved \$3.50 in October and \$3.95 in November. How much more does he need to buy the watch?
3. Betsy's father drove her 117 mi. to camp. They left home at 9:30 A.M. and arrived in camp at 12:30 P.M. Find the average number of miles they drove per hour.
4. Jim sells ice cream cones at school ball games. The last four Saturdays he sold 238 cones, 215 cones, 275 cones, and 308 cones. Find the average number he sold per game.
5. The price of the magazine that Ann wants is \$3.50 a year. She can get it for two years for \$6.00. How much will Ann save by taking the magazine for two years at \$6.00 instead of taking it at \$3.50 each year for two years?
6. Henry and Peter paid \$18.50 for a small tent and \$9.98 for a camp lantern. If the boys shared the cost equally, how much did each boy pay?
7. Handkerchiefs cost \$.39 each or 6 for \$1.98. How much can be saved on each handkerchief by buying 6 at a time?
8. Susan bought a box of 48 packages of seeds for \$2.00. She sold all the seeds at \$.07 a package. How much more did she get for the seeds than she paid for them?
9. Andy bought 2 bicycle tires at \$2.98 each. He also purchased a wire basket for \$1.79, a headlight for \$3.59, and a horn for \$.85. How much did Andy spend all together?
10. The girls in the cooking class made 220 cookies. They sold 9 doz. cookies and used the rest for a class party. How many cookies did they have for the party?
11. George can buy one roll of film for his camera for \$.45 or 3 rolls for \$1.20. How much can he save by buying 3 rolls at one time?



Insect Enemies

Many insects are enemies of man because each year they injure or destroy our trees, grains, vegetables, and fruits. In our homes they ruin clothing, rugs, and food. They also damage our livestock and livestock products.

1. The total damage in this country by insects and the cost of trying to control them is \$4,000,000,000 or more a year. There are about 175,000,000 people in the United States. If each one should pay \$20, would the amount of money raised be enough to pay for the damage done by insects in one year?



2. Every now and then someone has to throw away a partly used package of flour, nuts, or other food because it has been spoiled by insects. There are about 49,000,000 families in the United States. What would be the total loss if each family threw away during one year food worth 50¢ that was spoiled by insects? If each family threw away food worth 75¢?



3. Grasshoppers damage several kinds of crops and plants. Grasshoppers are found all over the United States but most of their damage is done in the western $\frac{2}{3}$ of the country. It is estimated that the losses due to grasshoppers in the grasshopper region amounted to \$789,000,000 in the 25 years from 1925 to 1950. What was the average loss per year due to damage by grasshoppers?
4. For a recent year 20 states reported a total loss of \$27,376,000 due to grasshopper damage. In that year what was the average loss per state due to grasshopper damage?
5. In one year the damage caused by insects to certain of our crops was estimated to cost these amounts:

Corn	\$136,278,000	Cotton	\$114,058,000
Potatoes	55,111,000	Apples	21,816,000
Wheat	56,190,000	Peaches	8,687,000

Find the total amount of the damage to these crops.

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Insect Enemies

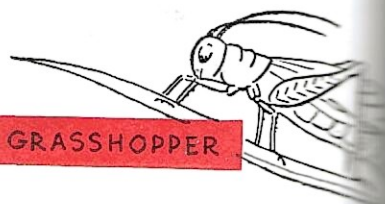
1. Insects cause great damage because there are so many of them. About 686,000 *different kinds* of insects have been named. Suppose you should try to learn the names of all these kinds of insects. If you could learn the names of 25 insects each day, how many days would it take to learn the names of 686,000 kinds of insects? How many weeks would it take? About how many years?
2. Beetles far outnumber other kinds of insects. About $\frac{2}{5}$ of the named kinds of insects are beetles. Ants, butterflies, bees, flies, wasps, and other insects make up the remainder. About how many kinds of insects are beetles? See ex. 1.
3. About $\frac{1}{8}$ of the named kinds of insects have been found in North America. About how many kinds of insects have been found in North America? See ex. 1.
4. In certain years much damage is done to trees by the *periodical cicada* or *17-year locust*. These locusts appear every 17 years in the North; during the other years they remain buried in the ground. In the town where Jack lives the 17-year locusts came the summer that he was 5 years old. How old will Jack be the next time the locusts come? the next two times they come after that?
5. In the South the locusts appear every 13 years instead of every 17 years as in the North. How many times would the 13-year locusts come during a period of 60 years if they first appear during the 13th year of this 60-year period?
6. When an insect is in danger, it often jumps or flies out of the way. A flea can jump 100 times as high as it is tall. If a boy 5 ft. tall could jump as well as a flea, he could jump 100 times his height. How high would that be? Could he jump over a 40-story skyscraper if each story were 12 ft. high?



LOCUST



MOTH



GRASSHOPPER

Addition and Subtraction

Add and check:

1.	3226	5313	9557	6336	7352	4015
	1136	3755	4374	803	2678	677
	284	1016	756	4969	957	1586
	3148	2185	4645	9825	6460	7492
	<u>4600</u>	<u>9228</u>	<u>8274</u>	<u>2017</u>	<u>5848</u>	<u>3818</u>
2.	1499	7080	4848	4460	9633	2998
	2594	317	3121	3523	1597	4614
	9312	6563	1645	8287	704	5007
	8658	412	7360	6557	2729	986
	<u>6977</u>	<u>4279</u>	<u>5297</u>	<u>1146</u>	<u>4337</u>	<u>1478</u>

Copy in columns, add, and check:

3. $5385 + 3147 + 8002 + 1984 + 2617 + 4796$
4. $2875 + 11,386 + 939 + 4406 + 2253 + 2568$
5. $6915 + 4676 + 10,755 + 5616 + 859 + 4179$
6. $62,987 + 9727 + 904 + 8323 + 4494 + 5329$
7. From \$200.00 subtract \$178.36; take 6425 from 7000.
8. Find the difference between \$575.00 and \$398.75.
9. How many feet longer than 1 mi. are 7146 ft.?
10. What is the change from \$10.00 for a purchase of \$9.64?

Subtract and check:

11.	35488	58194	43317	80000	32443
	<u>15254</u>	<u>25475</u>	<u>24654</u>	<u>3086</u>	<u>22578</u>
12.	62385	30000	68230	91554	70002
	<u>47426</u>	<u>14175</u>	<u>23631</u>	<u>23476</u>	<u>49257</u>
13.	86565	50923	73873	66925	80600
	<u>67078</u>	<u>33653</u>	<u>38986</u>	<u>19389</u>	<u>79358</u>

More Practice. See 12 on page 314.

Improving Your Skill

In the sixth grade you should begin to improve your skill in arithmetic so that you can work more rapidly and still have correct answers. The Improvement Tests in this book will help you because they will give you a way to improve your scores. You will find 3 addition tests on page 55, which are called Addition Tests 1a, 1b, and 1c. More addition tests are given on other pages of this book. If you take these tests the **right way**, they are sure to help you improve your skill.

1. When you take Addition Test 1a on page 55, the teacher will time you, allowing 5 min. for the test. At the end of the 5 min., you will stop work and the teacher will read the answers to the examples. There are 10 examples in Addition Test 1a, so your score will be 10 if you get all the examples right. If you get only 8 examples right, your score will be 8.
2. Suppose that you get a score of 8 today on Test 1a. Tomorrow the teacher will have the class take Addition Test 1b. This test is like Test 1a since each test contains 10 examples of the same kind in column addition. The teacher will give Test 1b the same way as described above, allowing 5 min. for it. Try to improve your score this time, so that it will be better than the score of 8 which you got on Test 1a. Suppose you get a score of 9 on Test 1b.
3. A day or so later the teacher will give you Addition Test 1c. **Never take more than one test a day.** Possibly you will get a score of 10 this time. But do not get discouraged if you fail to get 10, because you are sure to improve if you take each set of 3 tests in the way described above.
4. About a week later, the teacher will start you on a set of 3 subtraction tests which will help you better to subtract; see page 67. Later on, you will take some multiplication and division tests; see pages 74 and 95. All these tests are called Improvement Tests because they help you to improve your skill in arithmetic.

To the Teacher. See pages 56, 327, and 328 before giving Addition Test 1a.

Improving by Practice

Time: 5 min.

Addition Test 1a

1.	334	532	376	275	468
	286	378	817	552	154
	412	466	343	299	968
	<u>293</u>	<u>576</u>	<u>464</u>	<u>507</u>	<u>354</u>
2.	173	343	897	301	128
	216	850	928	417	694
	835	979	654	241	149
	<u>637</u>	<u>468</u>	<u>149</u>	<u>603</u>	<u>744</u> (10)

Time: 5 min.

Addition Test 1b

3.	713	132	534	486	174
	258	275	176	146	527
	524	807	665	894	993
	<u>465</u>	<u>355</u>	<u>436</u>	<u>283</u>	<u>306</u>
4.	523	813	157	376	440
	786	579	192	960	782
	660	258	846	939	311
	<u>298</u>	<u>478</u>	<u>579</u>	<u>684</u>	<u>168</u> (10)

Time: 5 min.

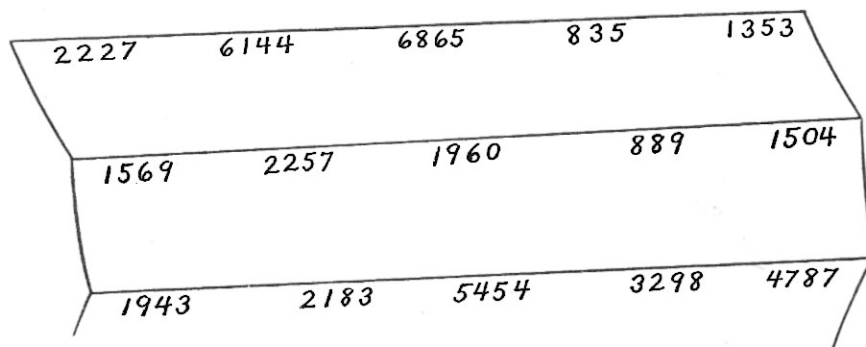
Addition Test 1c

5.	628	683	296	793	957
	499	807	534	455	636
	714	965	887	677	788
	<u>362</u>	<u>545</u>	<u>128</u>	<u>907</u>	<u>449</u>
6.	924	238	312	828	551
	534	725	493	141	467
	796	754	341	122	301
	<u>818</u>	<u>459</u>	<u>457</u>	<u>273</u>	<u>388</u> (10)

To the Teacher. The Improvement Tests above are to be given to the pupils on three different days. See page 328 for the procedure to follow.

Using Folded Paper

1. When you take an addition test like those on page 55, or a subtraction test like those on page 67, do not copy the examples. Instead, lay a sheet of paper on the book with its edge **under** the top row of examples. Then write the answer to each example on the edge of the paper, as shown at the bottom of this page.
2. When you finish the answers to the first row of examples, fold the answers **under**; then write the answers to the second row along the folded edge, as shown below. Continue in this way for each row of examples. It saves time to fold the paper **before** taking the test. Each fold should be about 1 inch wide.
3. Folded paper cannot be used for tests in multiplication and division like those on pages 74 and 95. In taking such tests you should copy the examples on paper **before** the test begins. In copying, spread the examples over the paper so as to give room enough to work them.
4. Work on each test only the number of minutes given for that test, and stop work **at once at the end of that time**. You cannot compare your scores on the 3 tests in a set unless you allow exactly the same number of minutes for each one of the tests.
5. If you finish a test before the time to stop, check as many of the examples as you can in the time that is left.

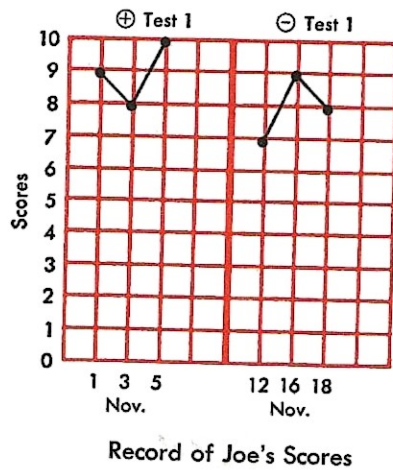


Using a Scoring Table

NUMBER OF EXAMPLES IN TEST	NUMBER OF EXAMPLES RIGHT															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4	0	3	5	8	10											
5	0	2	4	6	8	10										
6	0	2	3	5	7	8	10									
7	0	1	3	4	6	7	9	10								
8	0	1	3	4	5	6	8	9	10							
9	0	1	2	3	4	6	7	8	9	10						
10	0	1	2	3	4	5	6	7	8	9	10					
12	0	1	2	3	3	4	5	6	7	8	8	9	10			
15	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10

1. When a test contains 10 examples, it is easy to score it; if you get 9 examples right, your score is 9. When a test contains 15 examples, like the tests on page 67, your score is 10 if you get 15 examples right; but what is your score if you get 14 examples right, or only 12 right? The scoring table above answers this question.
2. Suppose you take a test containing 15 examples and you get only 12 examples right. You find your score in the table like this: Since the test had 15 examples, look down the first column on the left side of the table until you come to the row marked 15 (shown by Arrow A). Then look along that row until you reach the column marked 12 at the top (shown by Arrow B) and you will find the number 8 (shown by Arrow C). This means that your score is 8 on that test.
3. In the third row of Subtraction Test 1a on page 67 you see a number in a circle like this: (15). This tells you that this test contains 15 examples, so it is not necessary to count to see how many examples the entire test contains.
4. The scoring table shown above is also printed on page 329 of this book.

Recording Your Scores

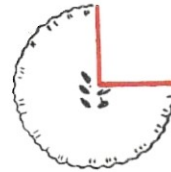


- The picture at the left shows Joe's scores on some tests that he took. This picture is called a **line graph**.
- The top of the first graph is marked "⊕ Test 1." This line graph shows Joe's scores for Addition Tests 1a, 1b, and 1c, on page 55. These three tests make up Test 1. ⊕ means "addition." You see three heavy dots on the graph. The first dot is on the horizontal line marked 9; this means that Joe's score on Test 1a was 9. The first dot is also on the vertical line marked 1 at the bottom of the graph; this means that Joe took Test 1a on Nov. 1. The second dot shows Joe's score on Test 1b; his score was 8 and he took the test on Nov. 3. What was his score on Test 1c and on what date did he take that test? The dots on a line graph are connected by drawing lines between them.
- The second graph headed "⊖ Test 1" gives Joe's scores on the 3 subtraction tests on page 67. ⊖ means "subtraction." What were his scores on these three tests and on what dates did he take them?
- You should make a **Score Book** in which you can make a line graph of your scores for each set of tests. It will be a record of your scores on all the Improvement Tests that you take this school year. This book can be easily made from a few sheets of squared paper. Always watch your scores to see whether you are improving or not.
- When you find your score on a test, count only the examples that are entirely right. An example that is partly finished does not count.

Fractions

1. A fraction may have different meanings, as shown below:

(1) The picture at the right shows $\frac{3}{4}$ of a pie. Here the fraction $\frac{3}{4}$ stands for **three of the four equal parts of one thing**. This same meaning of a fraction is shown by $\frac{1}{2}$ of an orange or $\frac{2}{3}$ of a cake.



(2) Ann's mother used $\frac{3}{4}$ of a dozen cupcakes. Here the fraction $\frac{3}{4}$ stands for **three of the four equal parts of a group of things**. The group is 12 cakes. Then $\frac{3}{4}$ of 12 cakes is 9 cakes. This same meaning of a fraction is used when you say $\frac{2}{3}$ of 9 hens, or $\frac{1}{2}$ of 16 oz.



(3) A fraction can also indicate division. The fraction $\frac{3}{8}$ means $3 \div 8$. Likewise, the fraction $\frac{7}{16}$ means $7 \div 16$.

2. In the fraction $\frac{3}{4}$, 3 is the **numerator** of the fraction and 4 is the **denominator** of the fraction. The numerator and denominator are called the **terms** of the fraction.
3. You know that the fraction $\frac{3}{4}$ has the **same value** as the fraction $\frac{9}{12}$. A quick way to change the fraction $\frac{3}{4}$ to $\frac{9}{12}$ is to multiply both terms of $\frac{3}{4}$ by 3, as shown at A.

$$A. \frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$$

$$B. \frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$$

You can change $\frac{9}{12}$ back to $\frac{3}{4}$ by dividing both terms of $\frac{9}{12}$ by 3, as shown above at B. When you change $\frac{9}{12}$ to $\frac{3}{4}$, you reduce $\frac{9}{12}$ to its lowest terms. A fraction is reduced to lowest terms by dividing both terms by the largest whole number that will divide both exactly.

If you multiply or divide both terms of a fraction by the same number, you get another fraction having the same value.

Reducing Fractions

- Ann needs 27 in. of cloth to finish the dress she is making. What part of a yard should she buy?
 ► Ann needs $\frac{27}{36}$ yd., which reduces to $\frac{3}{4}$ yd. By what number do you divide both terms of $\frac{27}{36}$ to change it to $\frac{3}{4}$?
- Mrs. Rich bought 8 oz. of cheese. What part of a pound of cheese did she buy?
- Each day Judy practices 45 min. on the piano. What part of an hour does she practice each day?
- Ted and Bob together picked 16 qt. of berries one day. What part of a bushel is 16 qt.? 32 qt. = 1 bu.
- Today Mr. Wells drove his car 120 mi. all together. He drove 72 mi. this morning and then stopped for lunch. What part of the trip did he complete before lunch?
- George goes away to school. He is away from home 9 mo. of the year. What part of the year is he away from home?

In each exercise tell what number should be put in the numerator of the second fraction so that both fractions will be equal:

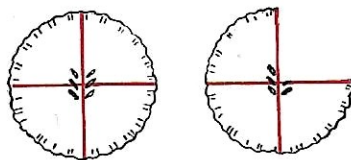
- | | | | | |
|---------------------------------|------------------------------|------------------------------|-------------------------------|--------------------------------|
| 7. $\frac{1}{3} = \frac{?}{6}$ | $\frac{5}{8} = \frac{?}{16}$ | $\frac{4}{5} = \frac{?}{10}$ | $\frac{5}{12} = \frac{?}{60}$ | $\frac{3}{4} = \frac{?}{100}$ |
| 8. $\frac{1}{2} = \frac{?}{4}$ | $\frac{2}{3} = \frac{?}{12}$ | $\frac{5}{6} = \frac{?}{12}$ | $\frac{7}{12} = \frac{?}{24}$ | $\frac{3}{5} = \frac{?}{100}$ |
| 9. $\frac{3}{4} = \frac{?}{8}$ | $\frac{1}{4} = \frac{?}{16}$ | $\frac{2}{5} = \frac{?}{10}$ | $\frac{3}{10} = \frac{?}{50}$ | $\frac{1}{2} = \frac{?}{100}$ |
| 10. $\frac{1}{2} = \frac{?}{6}$ | $\frac{1}{2} = \frac{?}{10}$ | $\frac{7}{8} = \frac{?}{16}$ | $\frac{1}{12} = \frac{?}{36}$ | $\frac{9}{10} = \frac{?}{100}$ |

Reduce each fraction to lowest terms and tell by what number you divide both terms:

- | | | | | | | | | |
|---------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|
| 11. $\frac{4}{10}$ | $\frac{6}{18}$ | $\frac{8}{16}$ | $\frac{27}{36}$ | $\frac{15}{25}$ | $\frac{10}{15}$ | $\frac{20}{30}$ | $\frac{30}{50}$ | $\frac{50}{100}$ |
| 12. $\frac{12}{16}$ | $\frac{20}{24}$ | $\frac{16}{32}$ | $\frac{10}{18}$ | $\frac{15}{20}$ | $\frac{8}{40}$ | $\frac{50}{60}$ | $\frac{60}{80}$ | $\frac{60}{100}$ |
| 13. $\frac{8}{12}$ | $\frac{12}{15}$ | $\frac{18}{24}$ | $\frac{8}{32}$ | $\frac{14}{16}$ | $\frac{9}{12}$ | $\frac{10}{20}$ | $\frac{25}{40}$ | $\frac{75}{100}$ |
| 14. $\frac{16}{20}$ | $\frac{10}{12}$ | $\frac{24}{36}$ | $\frac{4}{18}$ | $\frac{10}{32}$ | $\frac{30}{60}$ | $\frac{60}{90}$ | $\frac{25}{50}$ | $\frac{35}{100}$ |

Kinds of Fractions

1. You see 1 whole pie and $\frac{3}{4}$ of another pie. The pies are cut into fourths. The pie on the right is less than 1 whole pie; it is $\frac{3}{4}$ of a pie. The fraction $\frac{3}{4}$, in which the numerator is less than the denominator, is a **proper fraction**. A proper fraction is less than 1 whole unit.



2. How many fourths of a pie do you see all together? The fraction $\frac{7}{4}$ shows more than 1 whole unit. The fraction $\frac{7}{4}$ is an **improper fraction**. How many fourths are there in 1 whole pie? The fraction $\frac{4}{4}$ is also an improper fraction. An improper fraction is equal to or larger than 1 whole unit.

3. You see $1\frac{3}{4}$ pies above. Numbers like $1\frac{3}{4}$, which are made of a whole number and a fraction, are **mixed numbers**.

4. To change an improper fraction to a whole number or to a mixed number, divide the numerator by the denominator. For example, $\frac{4}{4} = 4 \div 4 = 1$; $\frac{7}{4} = 7 \div 4 = 1\frac{3}{4}$; and $\frac{10}{4} = 10 \div 4 = 2\frac{1}{2}$.

5. You know that $\frac{6}{1} = 6$. This shows that any whole number may be written in the form of a fraction with a denominator of 1. For example, 8 may be written as $\frac{8}{1}$. Tell how to write 3 in the form of a fraction.

a. Tell which of the fractions below are proper fractions and which are improper fractions:

$\frac{3}{5}$ $\frac{7}{7}$ $\frac{10}{16}$ $\frac{1}{2}$ $\frac{12}{4}$ $\frac{18}{5}$ $\frac{12}{12}$ $\frac{7}{12}$ $\frac{14}{16}$

Change each fraction to a whole number or to a mixed number. Be sure that the fraction in the answer is in lowest terms:

1. $\frac{8}{8}$	2. $\frac{10}{4}$	3. $\frac{16}{8}$	4. $\frac{12}{5}$	5. $\frac{17}{12}$	6. $\frac{24}{10}$	7. $\frac{25}{25}$	8. $\frac{18}{6}$	9. $\frac{40}{12}$
10. $\frac{9}{12}$	11. $\frac{12}{6}$	12. $\frac{12}{8}$	13. $\frac{20}{8}$	14. $\frac{20}{16}$	15. $\frac{75}{24}$	16. $\frac{80}{30}$	17. $\frac{29}{6}$	18. $\frac{66}{12}$
19. $\frac{15}{12}$	20. $\frac{25}{6}$	21. $\frac{11}{8}$	22. $\frac{15}{5}$	23. $\frac{15}{10}$	24. $\frac{28}{12}$	25. $\frac{20}{15}$	26. $\frac{20}{3}$	27. $\frac{42}{16}$



Adding Fractions

1. **Problem** At the candy store Jean bought $1\frac{1}{2}$ lb. of chocolate creams, $2\frac{1}{2}$ lb. of maple candy, and $1\frac{1}{2}$ lb. of molasses chips for a school party. How many pounds in all did she buy?

Explanation Since the fractions all have the same denominator, you add the fractions by adding the numerators. The sum is $\frac{3}{2}$. Change $\frac{3}{2}$ to $1\frac{1}{2}$; then add $1\frac{1}{2}$ to 4, which gives $5\frac{1}{2}$. Jean bought $5\frac{1}{2}$ lb. of candy.

$$\begin{array}{r} 1\frac{1}{2} \\ 2\frac{1}{2} \\ 1\frac{1}{2} \\ \hline 4\frac{3}{2} = 5\frac{1}{2} \end{array}$$

2. Study these addition examples:

$$\begin{array}{r} \frac{1}{3} \\ \frac{1}{3} \\ \hline \frac{2}{3} \end{array}$$

$$\begin{array}{r} 2\frac{1}{4} \\ 3\frac{1}{4} \\ \hline 5\frac{2}{4} = 5\frac{1}{2} \end{array}$$

$$\begin{array}{r} \frac{5}{6} \\ \frac{1}{6} \\ \hline \frac{6}{6} = 1 \end{array}$$

$$\begin{array}{r} 2\frac{9}{10} \\ 4\frac{7}{10} \\ \hline 6\frac{16}{10} = 7\frac{6}{10} = 7\frac{3}{5} \end{array}$$

Add. Check by going over your work:

3.	$\frac{1}{5}$ $\frac{1}{5}$ $\frac{2}{5}$	$\frac{1}{6}$ $\frac{1}{6}$ $\frac{2}{6}$	$2\frac{1}{2}$ $3\frac{1}{2}$ $5\frac{2}{2} = 6$	$7\frac{1}{4}$ $\frac{1}{4}$ $7\frac{2}{4} = 7\frac{1}{2}$	$5\frac{7}{12}$ $2\frac{5}{12}$ $7\frac{12}{12} = 7\frac{1}{1} = 8$	$5\frac{2}{3}$ $7\frac{2}{3}$ $12\frac{4}{3} = 13\frac{1}{3}$	$1\frac{4}{9}$ $2\frac{8}{9}$ $3\frac{12}{9} = 4$
4.	$\frac{1}{8}$ $\frac{1}{8}$ $\frac{2}{8}$	$\frac{3}{4}$ $\frac{1}{4}$ 1	$4\frac{3}{4}$ $1\frac{3}{4}$ $5\frac{6}{4} = 6\frac{3}{2} = 7\frac{1}{2}$	$3\frac{7}{8}$ $6\frac{5}{8}$ $9\frac{12}{8} = 10\frac{3}{2} = 11\frac{1}{2}$	$2\frac{9}{10}$ $\frac{3}{10}$ 3	$7\frac{7}{8}$ $2\frac{3}{8}$ $9\frac{10}{8} = 11\frac{1}{4}$	$5\frac{3}{8}$ $1\frac{5}{8}$ $6\frac{8}{8} = 7$
5.	$\frac{1}{8}$ $\frac{3}{8}$ $\frac{1}{8}$ $\frac{5}{8}$	$\frac{1}{4}$ $\frac{3}{4}$ $\frac{1}{4}$ $1\frac{5}{4} = 1\frac{1}{2}$	$2\frac{1}{4}$ $3\frac{1}{4}$ $1\frac{1}{4}$ $6\frac{3}{4}$	$6\frac{1}{8}$ $1\frac{3}{8}$ $\frac{3}{8}$ $7\frac{4}{8} = 8\frac{1}{2}$	$2\frac{3}{16}$ $4\frac{5}{16}$ $1\frac{7}{16}$ $7\frac{15}{16}$	$2\frac{1}{3}$ $8\frac{2}{3}$ $4\frac{1}{3}$ $14\frac{4}{3} = 15\frac{2}{3}$	$4\frac{3}{4}$ $2\frac{1}{4}$ $6\frac{3}{4}$ $13\frac{7}{4} = 14\frac{3}{4}$



chocolate
chips
she buy?

$$\begin{array}{r} 1\frac{1}{2} \\ 2\frac{1}{2} \\ 1\frac{1}{2} \\ \hline 4\frac{3}{2} = 5\frac{1}{2} \end{array}$$

$$7\frac{6}{10} = 7\frac{3}{5}$$

$$\begin{array}{r} 1\frac{4}{9} \\ 2\frac{8}{9} \\ \hline \end{array}$$

$$\begin{array}{r} 5\frac{3}{8} \\ 1\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} 4\frac{3}{4} \\ 2\frac{1}{4} \\ 6\frac{3}{4} \\ \hline \end{array}$$

Using Fractions

- Mrs. Hunt bought two chickens at the store. One chicken weighed $2\frac{3}{4}$ lb. and the other weighed $3\frac{1}{4}$ lb. How much did both chickens weigh?
- Ann bought $1\frac{3}{4}$ lb. of chocolate candy and $2\frac{3}{4}$ lb. of maple creams. How many pounds of candy did Ann buy?
- Jim and his father drove $8\frac{3}{10}$ mi. to Bay City and then drove $6\frac{9}{10}$ mi. to Grandview. How many miles had they driven when they reached Grandview?
- Bob works for Mr. Smith. Last week he worked $2\frac{1}{2}$ hr. on Wednesday afternoon and $4\frac{1}{2}$ hr. on Saturday. How many hours did Bob work that week?
- Jean is going to help her mother bake two cakes for a party. For one cake they will need $\frac{5}{8}$ of a cup of butter and for the other cake they will need $\frac{7}{8}$ of a cup. How much butter do they need for these two cakes?
- In the basket on his bicycle John carried three packages to the post office. Their weights were $2\frac{3}{8}$ lb., $3\frac{7}{8}$ lb., and $1\frac{1}{8}$ lb. How many pounds did John carry in his basket?

Add. Check by going over your work:

- | | | | | | | | |
|-----|--|--|---|--|--|--|---|
| 7. | $\frac{2}{5}$
$\frac{3}{5}$
<hr/> | $\frac{3}{8}$
$\frac{3}{8}$
<hr/> | $6\frac{1}{2}$
$\frac{1}{2}$
<hr/> | $5\frac{9}{16}$
$2\frac{15}{16}$
<hr/> | $8\frac{7}{10}$
$1\frac{3}{10}$
<hr/> | $4\frac{11}{12}$
$9\frac{7}{12}$
<hr/> | $3\frac{5}{6}$
$4\frac{5}{6}$
<hr/> |
| 8. | $\frac{5}{8}$
$\frac{7}{8}$
<hr/> | $\frac{3}{4}$
$\frac{1}{4}$
<hr/> | $8\frac{1}{3}$
$3\frac{1}{3}$
<hr/> | $4\frac{7}{10}$
$4\frac{9}{10}$
<hr/> | $3\frac{1}{12}$
$5\frac{7}{12}$
<hr/> | $2\frac{3}{16}$
$2\frac{15}{16}$
<hr/> | $7\frac{2}{3}$
$4\frac{2}{3}$
<hr/> |
| 9. | $\frac{2}{3}$
$\frac{2}{3}$
<hr/> | $\frac{1}{8}$
$\frac{1}{8}$
<hr/> | $4\frac{1}{8}$
$2\frac{7}{8}$
<hr/> | $3\frac{5}{16}$
$4\frac{7}{16}$
<hr/> | $8\frac{15}{16}$
$9\frac{13}{16}$
<hr/> | $4\frac{7}{12}$
$3\frac{11}{12}$
<hr/> | $1\frac{1}{2}$
$4\frac{1}{2}$
<hr/> |
| 10. | $\frac{1}{4}$
$\frac{3}{4}$
$\frac{3}{4}$
<hr/> | $\frac{1}{6}$
$\frac{5}{6}$
$\frac{5}{6}$
<hr/> | $2\frac{3}{4}$
$4\frac{3}{4}$
$8\frac{3}{4}$
<hr/> | $7\frac{3}{10}$
$6\frac{7}{10}$
$2\frac{9}{10}$
<hr/> | $2\frac{1}{16}$
$7\frac{3}{16}$
$5\frac{5}{16}$
<hr/> | $1\frac{3}{10}$
$5\frac{1}{10}$
$7\frac{7}{10}$
<hr/> | $2\frac{2}{5}$
$1\frac{3}{5}$
$6\frac{4}{5}$
<hr/> |

Adding Fractions

1. **Problem** Peter walked $\frac{3}{4}$ mi. to school, $1\frac{1}{2}$ mi. to the swimming pool, and then $1\frac{1}{8}$ mi. to get home. How many miles in all did Peter walk?

Explanation You cannot add halves, fourths, and eighths because fractions that you add must have like denominators. You can add $\frac{3}{4}$, $\frac{1}{2}$, and $\frac{1}{8}$ if you change them all to eighths, as shown at the right. The sum of the fractions is $\frac{11}{8}$. Change $\frac{11}{8}$ to $1\frac{3}{8}$; then add $1\frac{3}{8}$ to 2, which gives $3\frac{3}{8}$. Peter walked $3\frac{3}{8}$ mi.

$$\begin{aligned}\frac{3}{4} &= \frac{6}{8} \\ 1\frac{1}{2} &= 1\frac{4}{8} \\ 1\frac{1}{8} &= 1\frac{1}{8} \\ \hline 2\frac{11}{8} &= 3\frac{3}{8}\end{aligned}$$

To add fractions with unlike denominators, first change them to fractions with like denominators.

2. Study these addition examples:

$$\begin{array}{r} 2\frac{5}{12} = 2\frac{5}{12} \\ 7\frac{1}{4} = 7\frac{3}{12} \\ \hline 9\frac{8}{12} = 9\frac{2}{3} \end{array} \qquad \begin{array}{r} 4\frac{2}{3} = 4\frac{4}{6} \\ 1\frac{5}{6} = 1\frac{5}{6} \\ \hline 5\frac{9}{6} = 6\frac{3}{6} = 6\frac{1}{2} \end{array} \qquad \begin{array}{r} 1\frac{2}{3} = 1\frac{8}{12} \\ 3\frac{1}{4} = 3\frac{3}{12} \\ \hline 4\frac{11}{12} \end{array}$$

Add. Check by going over your work:

3. $\begin{array}{r} 6\frac{1}{4} \\ 3\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{9}{16} \\ 3\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 4\frac{3}{8} \\ \hline \end{array}$	$\begin{array}{r} 5\frac{7}{16} \\ 9\frac{3}{8} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{5}{12} \\ 4\frac{1}{6} \\ \hline \end{array}$	$\begin{array}{r} 4\frac{9}{16} \\ 6\frac{5}{8} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{1}{3} \\ 7\frac{1}{2} \\ \hline \end{array}$
4. $\begin{array}{r} 3\frac{1}{4} \\ 4\frac{5}{8} \\ \hline \end{array}$	$\begin{array}{r} 3\frac{3}{16} \\ 2\frac{7}{8} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{1}{2} \\ 4\frac{1}{3} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{4}{5} \\ 1\frac{7}{10} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{5}{8} \\ 4\frac{3}{16} \\ \hline \end{array}$	$\begin{array}{r} 5\frac{7}{12} \\ 2\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{1}{2} \\ 2\frac{2}{3} \\ \hline \end{array}$
5. $\begin{array}{r} 5\frac{1}{6} \\ 3\frac{1}{2} \\ 2\frac{1}{3} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{2}{3} \\ 4\frac{7}{12} \\ 1\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{5}{8} \\ 3\frac{1}{4} \\ 5\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{9}{16} \\ 4\frac{1}{2} \\ 7\frac{3}{16} \\ \hline \end{array}$	$\begin{array}{r} 3\frac{7}{10} \\ 1\frac{4}{5} \\ 2\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{3}{4} \\ 5\frac{1}{8} \\ 7\frac{9}{16} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{1}{3} \\ 4\frac{1}{3} \\ 5\frac{1}{6} \\ \hline \end{array}$

More Practice. See 13 on page 314.

swim-
miles

$$= 3\frac{3}{8}$$

$$\text{add } 1\frac{3}{8}$$

st
s.

$$= 1\frac{8}{12}$$

$$= 3\frac{3}{12}$$

$$4\frac{11}{12}$$

$$8\frac{1}{3}$$

$$7\frac{1}{2}$$

$$7\frac{1}{2}$$

$$2\frac{2}{3}$$

$$2\frac{1}{3}$$

$$4\frac{1}{3}$$

$$5\frac{1}{6}$$



Problems and Practice

1. Nancy and Judy are making three costumes for the school play. For trimming the costumes they used red ribbon of these lengths: $2\frac{3}{8}$ yd., $\frac{1}{2}$ yd., $\frac{3}{4}$ yd. How much red ribbon did the girls buy?
2. Mary's mother bought two packages of cheese. One weighed $1\frac{1}{4}$ lb. and the other weighed $1\frac{1}{2}$ lb. How much did both packages of cheese weigh?
3. Ted is going to make the top of a bench out of three boards with widths of $3\frac{5}{16}$ in., $4\frac{1}{2}$ in., and $3\frac{1}{4}$ in. He will place them side by side. How wide will the top of the bench be?

Add and check:

4.	$\frac{1}{8}$	$2\frac{5}{12}$	$6\frac{3}{4}$	$2\frac{3}{5}$	$4\frac{5}{12}$	$3\frac{7}{16}$	$6\frac{11}{16}$
	$\frac{7}{8}$	$7\frac{1}{4}$	$3\frac{2}{3}$	$2\frac{3}{10}$	$2\frac{5}{6}$	$9\frac{7}{8}$	$8\frac{3}{16}$
5.	$\frac{2}{3}$	$1\frac{2}{3}$	$3\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{7}{10}$	$5\frac{7}{8}$	$4\frac{3}{10}$
	$\frac{5}{6}$	$6\frac{1}{12}$	$4\frac{7}{8}$	$4\frac{3}{10}$	$7\frac{1}{5}$	$2\frac{11}{16}$	$8\frac{1}{2}$
6.	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{3}{8}$	$4\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{1}{5}$	$2\frac{7}{16}$
	$\frac{1}{2}$	$5\frac{5}{6}$	$\frac{3}{8}$	$4\frac{4}{5}$	$2\frac{3}{8}$	$2\frac{3}{10}$	$1\frac{3}{8}$
	$\frac{5}{8}$	$1\frac{11}{12}$	$8\frac{7}{8}$	$5\frac{9}{10}$	$4\frac{7}{16}$	$1\frac{1}{2}$	$1\frac{3}{4}$
7.	$\frac{7}{8}$	$3\frac{11}{16}$	$8\frac{1}{8}$	$7\frac{11}{12}$	$2\frac{3}{4}$	$6\frac{1}{3}$	$2\frac{9}{10}$
	$\frac{7}{8}$	$7\frac{3}{16}$	$1\frac{1}{2}$	$4\frac{5}{6}$	$4\frac{7}{16}$	$5\frac{3}{4}$	$7\frac{9}{10}$
	$\frac{5}{8}$	$4\frac{1}{16}$	$7\frac{1}{4}$	$1\frac{1}{3}$	$4\frac{1}{2}$	$8\frac{7}{12}$	$4\frac{3}{5}$

Subtracting Fractions

1. **Problem** Ann has a piece of cloth $2\frac{3}{4}$ yd. long. If she makes a skirt that takes $1\frac{1}{2}$ yd., how much cloth will be left?

Explanation You cannot subtract $\frac{1}{2}$ from $\frac{3}{4}$ as they stand because these fractions have different denominators. Change $\frac{1}{2}$ to $\frac{2}{4}$; then subtract $\frac{2}{4}$ from $\frac{3}{4}$. Ann will have $1\frac{1}{4}$ yd. of cloth left.

$$\begin{array}{r} 2\frac{3}{4} = 2\frac{3}{4} \\ 1\frac{1}{2} = 1\frac{2}{2} \\ \hline 1\frac{1}{4} \end{array}$$

2. Bob agreed to work in the garden $6\frac{1}{2}$ hr. this week. By Thursday night he had worked $3\frac{1}{4}$ hr. How many more hours does Bob have to work this week?
3. Dick weighs $88\frac{3}{4}$ lb. and Tony weighs $86\frac{1}{8}$ lb. How many more pounds does Dick weigh than Tony?

Subtract. Check by going over your work:

- | | | | | | | |
|---|---|--|--|---|--|--|
| 4. $\frac{3}{4} - \frac{1}{4}$ | $\frac{9}{10} - \frac{3}{10}$ | $\frac{1}{2} - \frac{1}{8}$ | $\frac{5}{6} - \frac{5}{12}$ | $\frac{7}{8} - \frac{1}{2}$ | | |
| 5. $\frac{7}{8} - \frac{1}{8}$ | $\frac{11}{16} - \frac{3}{16}$ | $\frac{1}{2} - \frac{1}{4}$ | $\frac{5}{8} - \frac{3}{16}$ | $\frac{2}{3} - \frac{1}{2}$ | | |
| 6. $3\frac{3}{4}$
<u>$1\frac{1}{4}$</u> | $4\frac{13}{16}$
<u>$1\frac{9}{16}$</u> | $9\frac{5}{6}$
<u>$4\frac{1}{6}$</u> | $6\frac{7}{10}$
<u>$3\frac{1}{2}$</u> | $4\frac{9}{10}$
<u>$2\frac{3}{5}$</u> | $2\frac{1}{2}$
<u>$1\frac{1}{3}$</u> | $7\frac{5}{8}$
<u>$\frac{3}{8}$</u> |
| 7. $2\frac{7}{8}$
<u>$1\frac{1}{8}$</u> | $6\frac{7}{16}$
<u>$2\frac{3}{16}$</u> | $5\frac{7}{8}$
<u>$3\frac{1}{4}$</u> | $4\frac{15}{16}$
<u>$1\frac{1}{4}$</u> | $7\frac{3}{5}$
<u>$2\frac{1}{10}$</u> | $6\frac{1}{2}$
<u>$4\frac{1}{5}$</u> | $5\frac{2}{3}$
<u>$2\frac{1}{6}$</u> |
| 8. $4\frac{7}{8}$
<u>$4\frac{3}{4}$</u> | $7\frac{7}{12}$
<u>$1\frac{5}{12}$</u> | $5\frac{2}{3}$
<u>$1\frac{1}{4}$</u> | $6\frac{7}{16}$
<u>$4\frac{1}{8}$</u> | $7\frac{11}{12}$
<u>$4\frac{5}{12}$</u> | $5\frac{2}{3}$
<u>$1\frac{1}{2}$</u> | $2\frac{3}{4}$
<u>$2\frac{5}{8}$</u> |
| 9. $7\frac{3}{5}$
<u>$2\frac{1}{2}$</u> | $2\frac{7}{16}$
<u>$\frac{3}{8}$</u> | $5\frac{3}{4}$
<u>$1\frac{1}{3}$</u> | $6\frac{1}{2}$
<u>$4\frac{5}{12}$</u> | $7\frac{4}{5}$
<u>$3\frac{7}{10}$</u> | $9\frac{3}{8}$
<u>$2\frac{1}{4}$</u> | $5\frac{1}{3}$
<u>$3\frac{1}{6}$</u> |
| 10. $4\frac{1}{2}$
<u>$\frac{3}{8}$</u> | $8\frac{1}{2}$
<u>$7\frac{3}{10}$</u> | $8\frac{1}{2}$
<u>$4\frac{1}{2}$</u> | $7\frac{15}{16}$
<u>$2\frac{1}{2}$</u> | $9\frac{1}{2}$
<u>$2\frac{1}{12}$</u> | $8\frac{3}{4}$
<u>$1\frac{2}{3}$</u> | $5\frac{1}{2}$
<u>$1\frac{1}{8}$</u> |

More Practice. See 14 on page 315.

Improving by Practice

Subtraction Test 1a.

Time: 4 min.

1. $\begin{array}{r} 5689 \\ 3462 \\ \hline \end{array}$	$\begin{array}{r} 8793 \\ 2649 \\ \hline \end{array}$	$\begin{array}{r} 8761 \\ 1896 \\ \hline \end{array}$	$\begin{array}{r} 4080 \\ 3245 \\ \hline \end{array}$	$\begin{array}{r} 5549 \\ 4196 \\ \hline \end{array}$
2. $\begin{array}{r} 3306 \\ 1737 \\ \hline \end{array}$	$\begin{array}{r} 3476 \\ 1219 \\ \hline \end{array}$	$\begin{array}{r} 7204 \\ 5244 \\ \hline \end{array}$	$\begin{array}{r} 6458 \\ 5569 \\ \hline \end{array}$	$\begin{array}{r} 4000 \\ 2496 \\ \hline \end{array}$
3. $\begin{array}{r} 5268 \\ 3325 \\ \hline \end{array}$	$\begin{array}{r} 8000 \\ 5817 \\ \hline \end{array}$	$\begin{array}{r} 8037 \\ 2583 \\ \hline \end{array}$	$\begin{array}{r} 7041 \\ 3743 \\ \hline \end{array}$	$\begin{array}{r} 6365 \\ 1578 \\ \hline \end{array}$ (15)

Subtraction Test 1b.

Time: 4 min.

4. $\begin{array}{r} 5878 \\ 2371 \\ \hline \end{array}$	$\begin{array}{r} 7822 \\ 4718 \\ \hline \end{array}$	$\begin{array}{r} 6623 \\ 2657 \\ \hline \end{array}$	$\begin{array}{r} 4278 \\ 1449 \\ \hline \end{array}$	$\begin{array}{r} 2538 \\ 2368 \\ \hline \end{array}$
5. $\begin{array}{r} 7337 \\ 2698 \\ \hline \end{array}$	$\begin{array}{r} 4564 \\ 1348 \\ \hline \end{array}$	$\begin{array}{r} 9716 \\ 4746 \\ \hline \end{array}$	$\begin{array}{r} 5521 \\ 4889 \\ \hline \end{array}$	$\begin{array}{r} 3464 \\ 1532 \\ \hline \end{array}$
6. $\begin{array}{r} 7151 \\ 5977 \\ \hline \end{array}$	$\begin{array}{r} 8088 \\ 5152 \\ \hline \end{array}$	$\begin{array}{r} 8000 \\ 3248 \\ \hline \end{array}$	$\begin{array}{r} 6604 \\ 1636 \\ \hline \end{array}$	$\begin{array}{r} 9000 \\ 7573 \\ \hline \end{array}$ (15)

Subtraction Test 1c.

Time: 4 min.

7. $\begin{array}{r} 3957 \\ 2652 \\ \hline \end{array}$	$\begin{array}{r} 3867 \\ 3319 \\ \hline \end{array}$	$\begin{array}{r} 9135 \\ 6579 \\ \hline \end{array}$	$\begin{array}{r} 8607 \\ 1241 \\ \hline \end{array}$	$\begin{array}{r} 5424 \\ 3479 \\ \hline \end{array}$
8. $\begin{array}{r} 7322 \\ 4436 \\ \hline \end{array}$	$\begin{array}{r} 3080 \\ 2367 \\ \hline \end{array}$	$\begin{array}{r} 8643 \\ 7756 \\ \hline \end{array}$	$\begin{array}{r} 7000 \\ 2586 \\ \hline \end{array}$	$\begin{array}{r} 6307 \\ 4387 \\ \hline \end{array}$
9. $\begin{array}{r} 4498 \\ 3514 \\ \hline \end{array}$	$\begin{array}{r} 3278 \\ 1699 \\ \hline \end{array}$	$\begin{array}{r} 7000 \\ 5627 \\ \hline \end{array}$	$\begin{array}{r} 8082 \\ 5385 \\ \hline \end{array}$	$\begin{array}{r} 2242 \\ 1298 \\ \hline \end{array}$ (15)

To the Teacher. The Improvement Tests above are to be given to the pupils on three different days. See page 328 for the procedure to follow.

Preparing to Subtract Fractions

1. Today at the bank Betsy had \$5 changed into 4 dollars and 10 dimes. Does $\$5 = \$4\frac{10}{10}$?
2. Tom had 3 dollars and 4 dimes. If he changed 1 dollar into dimes, how many dollars and dimes did he have then? Does $\$3\frac{4}{10} = \$2\frac{14}{10}$?
3. Susan had 4 dollars and 3 quarters. If she changed 1 dollar into quarters, how many dollars and quarters did she have then? Does $\$4\frac{3}{4} = \$3\frac{7}{4}$?
4. Mr. Stone had 3 dollars and 1 half dollar. If he changed 1 dollar into half dollars, how many dollars and half dollars did he have then? Does $\$3\frac{1}{2} = \$2\frac{3}{2}$?
5. Henry had 8 dollars and 1 half dollar. If he changed the half dollar and 1 dollar into dimes, how many dollars and dimes did he have then? Does $\$8\frac{1}{2} = \$8\frac{5}{10} = \$7\frac{15}{10}$?

Tell what numbers go in the spaces and in the numerators:

6. \$5 equals \$4 and ... quarters. $5 = 4\frac{?}{4}$
7. \$7 equals \$6 and ... half dollars. $7 = 6\frac{?}{2}$
8. \$10 equals \$9 and ... dimes. $10 = 9\frac{?}{10}$
9. $\$5\frac{1}{4}$ equals \$4 and ... quarters. $5\frac{1}{4} = 4\frac{?}{4}$
10. $\$2\frac{1}{2}$ equals \$1 and ... half dollars. $2\frac{1}{2} = 1\frac{?}{2}$
11. $\$7\frac{1}{2}$ equals \$6 and ... dimes. $7\frac{1}{2} = 6\frac{?}{10}$
12. $\$3\frac{1}{2}$ equals \$2 and ... quarters. $3\frac{1}{2} = 2\frac{?}{4}$
13. $3 = 2\frac{?}{4}$ $3\frac{1}{6} = 2\frac{?}{6}$ $9\frac{1}{12} = 8\frac{?}{12}$ $8\frac{2}{3} = 8\frac{4}{6} = 7\frac{?}{6}$
14. $7 = 6\frac{?}{2}$ $6\frac{7}{8} = 5\frac{?}{8}$ $3\frac{5}{16} = 2\frac{?}{16}$ $4\frac{1}{2} = 4\frac{4}{8} = 3\frac{?}{8}$
15. $5 = 4\frac{?}{3}$ $8\frac{3}{5} = 7\frac{?}{5}$ $6\frac{3}{10} = 5\frac{?}{10}$ $7\frac{3}{4} = 7\frac{?}{8} = 6\frac{?}{8}$
16. $2 = 1\frac{?}{8}$ $7\frac{1}{4} = 6\frac{?}{4}$ $5\frac{9}{16} = 4\frac{?}{16}$ $3\frac{1}{2} = 3\frac{?}{10} = 2\frac{?}{10}$
17. $4 = 3\frac{?}{10}$ $9\frac{1}{3} = 8\frac{?}{3}$ $6\frac{5}{12} = 5\frac{?}{12}$ $5\frac{1}{4} = 5\frac{?}{12} = 4\frac{?}{12}$

More Practice. See 15 on page 315.



Going Fishing

1. **Problem** Dan and Tom went on an all-day fishing trip to Lake Pleasant. The distance to the lake was 10 mi. They took a bus for $8\frac{1}{2}$ mi. and walked the rest of the way. How far did they have to walk to reach Lake Pleasant?

Explanation To subtract a mixed number from 10 you must first change 10 to $9\frac{2}{2}$. Then you can subtract $\frac{1}{2}$ from $\frac{2}{2}$, which gives $\frac{1}{2}$, and 8 from 9. The boys had to walk $1\frac{1}{2}$ mi.

$$\begin{array}{r} 10 = 9\frac{2}{2} \\ - 8\frac{1}{2} = 8\frac{1}{2} \\ \hline 1\frac{1}{2} \end{array}$$

2. **Problem** The first fish Dan caught weighed $2\frac{1}{4}$ lb. and the first fish Tom caught weighed $1\frac{3}{4}$ lb. What is the difference in the weights of these two fish?

Explanation Since you cannot subtract $\frac{3}{4}$ from $\frac{1}{4}$, change $2\frac{1}{4}$ to $1\frac{5}{4}$. Then you can subtract $\frac{3}{4}$ from $\frac{5}{4}$ and 1 from 1. This gives $\frac{2}{4}$, which can be reduced to $\frac{1}{2}$. The difference in the weights of the fish is $\frac{1}{2}$ lb.

$$\begin{array}{r} 2\frac{1}{4} = 1\frac{5}{4} \\ - 1\frac{3}{4} = 1\frac{3}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

3. During the day Dan caught fish weighing a total of $8\frac{3}{4}$ lb. and Tom caught fish weighing a total of $11\frac{1}{4}$ lb. How much more did Tom's catch weigh than Dan's?
4. Study these subtraction examples:

$$\begin{array}{r} 1 = \frac{4}{4} \\ - \frac{3}{4} = \frac{3}{4} \\ \hline \frac{1}{4} \end{array}$$

$$\begin{array}{r} 8 = 7\frac{6}{6} \\ - 2\frac{1}{6} = 2\frac{1}{6} \\ \hline 5\frac{5}{6} \end{array}$$

$$\begin{array}{r} 5\frac{1}{3} = 4\frac{4}{3} \\ - 1\frac{2}{3} = 1\frac{2}{3} \\ \hline 3\frac{2}{3} \end{array}$$

$$\begin{array}{r} 6\frac{1}{8} = 5\frac{9}{8} \\ - 2\frac{5}{8} = 2\frac{5}{8} \\ \hline 3\frac{4}{8} = 3\frac{1}{2} \end{array}$$

Subtract. Check by going over your work:

$$\begin{array}{r} 5. \quad 8\frac{1}{4} \\ - 5\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ - \frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 5\frac{3}{8} \\ - 2\frac{7}{8} \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ - \frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} 7\frac{3}{16} \\ - 2\frac{5}{16} \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ - \frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 8\frac{5}{12} \\ - 1\frac{11}{12} \\ \hline \end{array}$$

More Practice. See 16 on page 315.

How Much Have They Grown?

1. **Problem** Don was $56\frac{1}{2}$ in. tall in June. In September he was $58\frac{1}{4}$ in. tall. How many inches did he grow in 3 mo.?

Explanation You must change $56\frac{1}{2}$ to $56\frac{2}{4}$ so that both fractions will have the same denominator. But you cannot subtract $\frac{2}{4}$ from $\frac{1}{4}$, so you must also change $58\frac{1}{4}$ to $57\frac{5}{4}$. Now subtract $56\frac{2}{4}$ from $57\frac{5}{4}$. Don grew $1\frac{3}{4}$ in.

$$\begin{array}{r} 58\frac{1}{4} = 57\frac{5}{4} \\ 56\frac{2}{4} = 56\frac{2}{4} \\ \hline 1\frac{3}{4} \end{array}$$

2. **Problem** Don weighed $83\frac{5}{8}$ lb. in June. In September he weighed $87\frac{1}{2}$ lb. How many pounds did he gain during the summer?

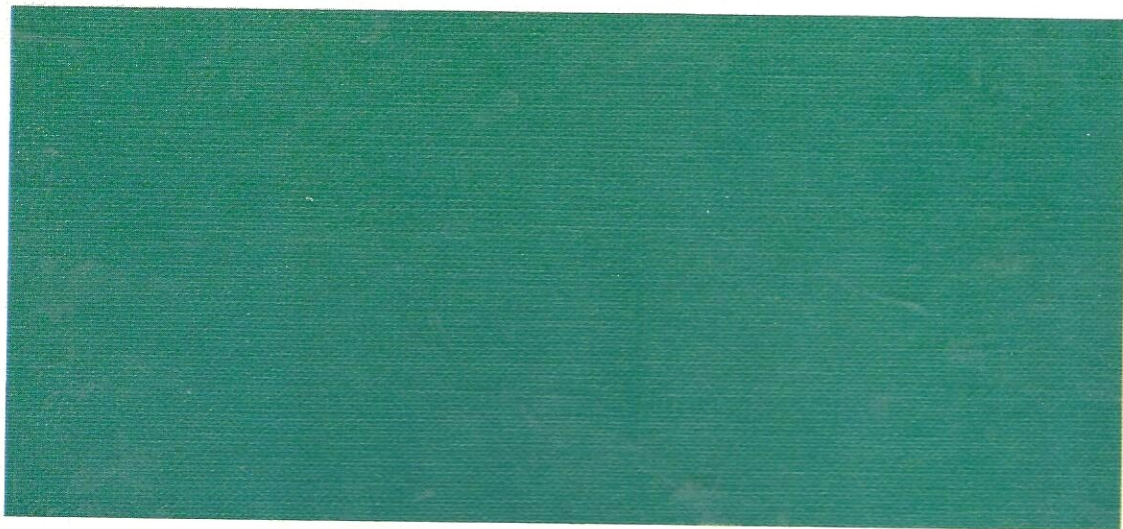
Explanation Eighths and halves do not have the same denominator, so you must change $87\frac{1}{2}$ to $87\frac{4}{8}$. But you cannot subtract $\frac{5}{8}$ from $\frac{4}{8}$, so you must also change $87\frac{4}{8}$ to $86\frac{12}{8}$. Then subtract $83\frac{5}{8}$ from $86\frac{12}{8}$. Don gained $3\frac{7}{8}$ lb.

$$\begin{array}{r} 87\frac{1}{2} = 87\frac{4}{8} = 86\frac{12}{8} \\ 83\frac{5}{8} = 83\frac{5}{8} \\ \hline 3\frac{7}{8} \end{array}$$

3. Don's sister Peggy was $54\frac{3}{4}$ in. tall in June. In September she was $55\frac{1}{2}$ in. tall. How many inches taller was Peggy in September than in June?

Subtract. Check the work by going over it:

- | | | | | | | |
|--|--|--|---|---|--|---|
| 4. $\begin{array}{r} 9\frac{1}{6} \\ 3\frac{1}{2} \\ \hline \end{array}$ | $\begin{array}{r} 7\frac{1}{5} \\ 1\frac{7}{10} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{1}{2} \\ 7\frac{7}{12} \\ \hline \end{array}$ | $\begin{array}{r} 6\frac{2}{5} \\ 2\frac{1}{2} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{1}{4} \\ 1\frac{7}{8} \\ \hline \end{array}$ | $\begin{array}{r} 2\frac{5}{12} \\ 1\frac{2}{3} \\ \hline \end{array}$ | $\begin{array}{r} 7\frac{1}{2} \\ 4\frac{2}{3} \\ \hline \end{array}$ |
| 5. $\begin{array}{r} 3\frac{1}{4} \\ 2\frac{1}{2} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{1}{8} \\ 6\frac{3}{16} \\ \hline \end{array}$ | $\begin{array}{r} 4\frac{3}{16} \\ 2\frac{1}{2} \\ \hline \end{array}$ | $\begin{array}{r} 7\frac{1}{8} \\ 3\frac{1}{2} \\ \hline \end{array}$ | $\begin{array}{r} 8 \\ 2\frac{2}{3} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{1}{4} \\ 5\frac{5}{16} \\ \hline \end{array}$ | $\begin{array}{r} 6 \\ \frac{5}{6} \\ \hline \end{array}$ |
| 6. $\begin{array}{r} 4\frac{3}{4} \\ \frac{7}{8} \\ \hline \end{array}$ | $\begin{array}{r} 5\frac{7}{10} \\ 4\frac{4}{5} \\ \hline \end{array}$ | $\begin{array}{r} 4\frac{3}{4} \\ 1\frac{5}{12} \\ \hline \end{array}$ | $\begin{array}{r} 5\frac{1}{2} \\ 2\frac{3}{4} \\ \hline \end{array}$ | $\begin{array}{r} 7\frac{1}{3} \\ 3\frac{5}{6} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{7}{16} \\ 1\frac{3}{4} \\ \hline \end{array}$ | $\begin{array}{r} 6\frac{1}{8} \\ 2\frac{3}{4} \\ \hline \end{array}$ |
| 7. $\begin{array}{r} 5\frac{1}{3} \\ 3\frac{3}{4} \\ \hline \end{array}$ | $\begin{array}{r} 6\frac{1}{4} \\ 2\frac{7}{16} \\ \hline \end{array}$ | $\begin{array}{r} 4\frac{1}{2} \\ \frac{13}{16} \\ \hline \end{array}$ | $\begin{array}{r} 9\frac{1}{2} \\ 4\frac{7}{8} \\ \hline \end{array}$ | $\begin{array}{r} 5\frac{1}{2} \\ 3\frac{5}{6} \\ \hline \end{array}$ | $\begin{array}{r} 4\frac{1}{2} \\ 3\frac{7}{10} \\ \hline \end{array}$ | $\begin{array}{r} 2\frac{1}{2} \\ 1\frac{4}{5} \\ \hline \end{array}$ |



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